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ABSTRACT

This manual is designed for teachers using units in the Career Oriented Mathematics Program titled: (1) Scale, (2) Apprenticeship: Learning to be a Cement Mason, (3) Textiles, (4) Being Self-Employed: Harvesting and Sale of Pulpwood, and (5) Lumber Yard Employee. Lesson plans, masters for dittos and transparencies, and problem solutions are provided. (SD)

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TEACHER'S MANUAL
CAREER ORIENTED
MATHEMATICS

SE 019 993

FOREWORD

This Career Oriented Mathematics Curriculum was prepared through a contractual agreement between the Berrien County Board of Education and Dr. Michael L. Mahaffey and Dr. William D. McKillip of the University of Georgia. Funding for this effort was provided by a grand from the Georgia State Department of Education, ESEA Title III.

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Contents

Scale 4
  1. General Information 5
  2. Lesson Plans 6
Apprenticeship: Learning to be a Cement Mason 27
  1. Apprentice Program 30
  2. Constructing Cement Forms 31
    Mission Incredible 33
  3. Volume: Dimensions in the same units 34
  4. Volume: Dimensions in mixed units 35
    Rip Off 36
  5. Cost of Concrete 36
  6. Review of Area Formulas 37
  7. Three Volume Formulas 38
    Rip Off 40
  8. Plane Surfaces 41
    Mission Incredible 42
  9. Cost of Cement Finishing 43
  10. Foundation for a House 44
    Rip Off 46
    Mission Incredible 48
  11. Opening The Sealed Bids 49
  12. Volume of Foundations Which are not Level 49
  13. Small Job Work 52
  14. Summary 53
    Hour Examinations follow lessions 5, 9, 14.
Textiles 66
  1. Discussion of Job 69
  2. Beginning the Job 69
    Mission Incredible 70
  3. Setting the Seam Guide 73
  4. Pattern Cutter and Marker 76
    Rip Off 78
  5. Cost of Garments 79
    Mission Incredible 80
  6. Waste 81
Being Self-Employed: Harvesting and Sale of Pulpwood 82
  1. Beginning To Learn The Business 85
  2. Harvesting By The Cord 86
  3. Units for Cutting and Sale 88
    Mission Incredible 89
  4. How Much Is Your Wood Worth? 90
  5. Financing Truck and Saw 93
    Mission Incredible 94
  6 & 7 Acres and Stumpage 95
  8 & 9 How Much Can You Make? 97
  10. Growing Wood: Cords Per Acre 99
  11. Finding Wood: Estimating The Height of a Tree 100

Contents (cont.)

12. Estimating Working Time, Costs, and Earnings 103
Mission Incredible 102
13. A Chance to be Self-Employed 105
14. Summary and Discussion 106
Hour examinations follow lessons 5, 9, and 14
Lumber Yard Employee 107
1. Discussion of Job 110
2. Lumber Yard Price List 110
3. Making Out Sales Receipt 111
Mission Incredible 113
4. Linear Feet 114
5. Board Feet (For 1 inch Lumber) 115
6. Board Feet (For 1 inch con't) 118
7. Board Feet (For 1 inch con't) 120
Rip Off 120
8. Pricing Lumber By the Board Foot 123
9. Board Feet (For 2 inch Lumber) 124
10. Selling Cut Lumber 126
11. Keeping a Running Inventory 128
12. Putting Down a Sub. Floor 130
13. Discounts 132
14. Summary 132

TEACHER'S MANUAL

SCALE

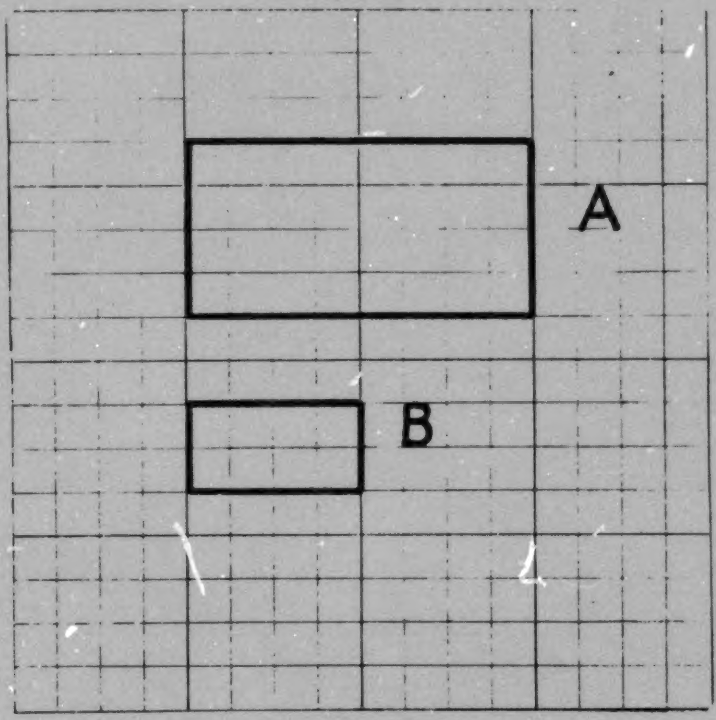
General Instruction

There are three units pertaining to measurement; (1) Scale Drawing; (2) Measurement, and (3) Area & Perimetic. These units should be taught in this order to have the best effect. There is an appendix to follow the third units, it contains optional activities related to measurement and a review assignment dealing with all three units. This assignment can be used in its entirity or in parts as each specific unit is completed. You may wish to use this as a test or review for the measurement lessons.

1. Scale

You have heard the term scale used in many different ways. For example, you may have built a "scale model" or made a "scale drawing". What do you think meant when we use the word "scale" in these ways.

One way of thinking about the word scale, is that it is a picture or model that looks exactly like the real object. Only the size may be bigger or smaller. For example in the following figure B is a scale drawing of A. Why?



2. Determining the Scale

To determine the scale of a model or a drawing is usually fairly easy. All we have to do is find out how the scale figure compares to the original, is it the same size, smaller, or larger. Then we find how much it has changed. Lets take a few examples to make

TAKE TIME TO LET THE STUDENTS DISCUSS WHAT THEY BELIEVE THE TERM "SCALE" MEANS. ALSO, HAVE THEM GIVE OTHER EXAMPLES OF WHERE THEY HAVE HEARD OR USED THE TERM "SCALE".

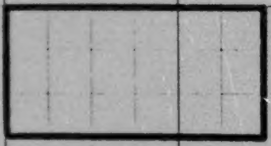
YOU SHOULD LET THE STUDENTS GIVE AS MANY REASONS AS THEY CAN. THEN MAKE SURE THAT THEY SEE THAT THE SCALE HAS SAME NUMBER OF SIDES, THE CORRESPONDING ANGLES ARE THE SAME, THE PICTURE "LOOKED" "RIGHT", OR THE SAME AS THE ORIGINAL (SIMILAR FIGURES).

PROJECT TRANSPARENCY/ (NO.1) WORKSHEET. ENCOURAGE STUDENTS TO DISCUSS WHICH SHAPE BELOW THE LINE IS THE "BEST" PICTURE OF THE SHAPE ABOVE THE LINE. THE "EXACT DUPLICATE" WILL, IN ALL LIKELIHOOD, BE JUDGED BEST. SAVE THE TRANSPARENCY AND HAVE THE STUDENTS SAVE THE WORKSHEETS.

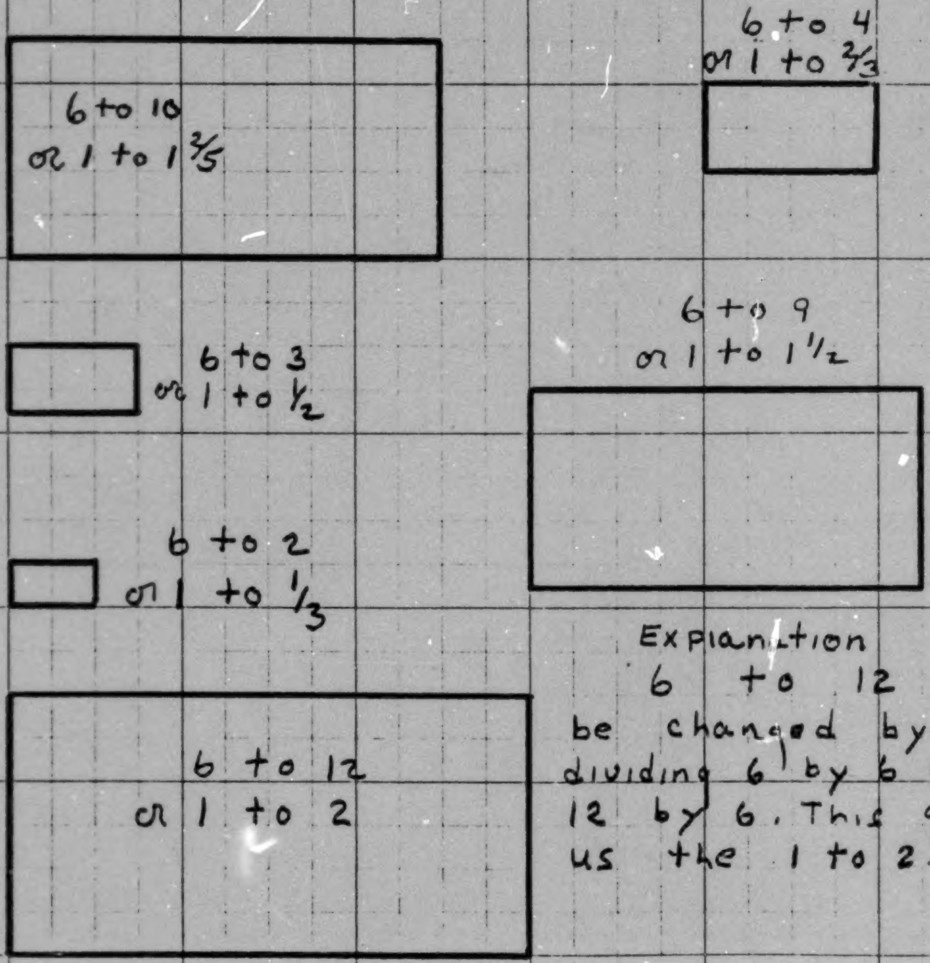
PROJECT TRANSPARENCY/ WORKSHEET NO. 2. HAND OUT THIS WORKSHEET. AGAIN DISCUSS WHICH SHAPE BELOW THE LINE IS THE "BEST" PICTURE OF THE SHAPE ABOVE THE LINE. THERE IS NO EXACT COPY. IT IS ASSUMED THAT THE SQUARES ARE THE "BEST" COPIES OF THE SQUARE ABOVE THE LINE. ENCOURAGE THE STUDENTS TO TELL HOW THEY ARE ALIKE AND HOW THEY ARE DIFFERENT. DISCUSS COPIES LARGER AND SMALLER THAN THE ORIGINAL.

END CLASS HERE

LESSON NUMBER 1

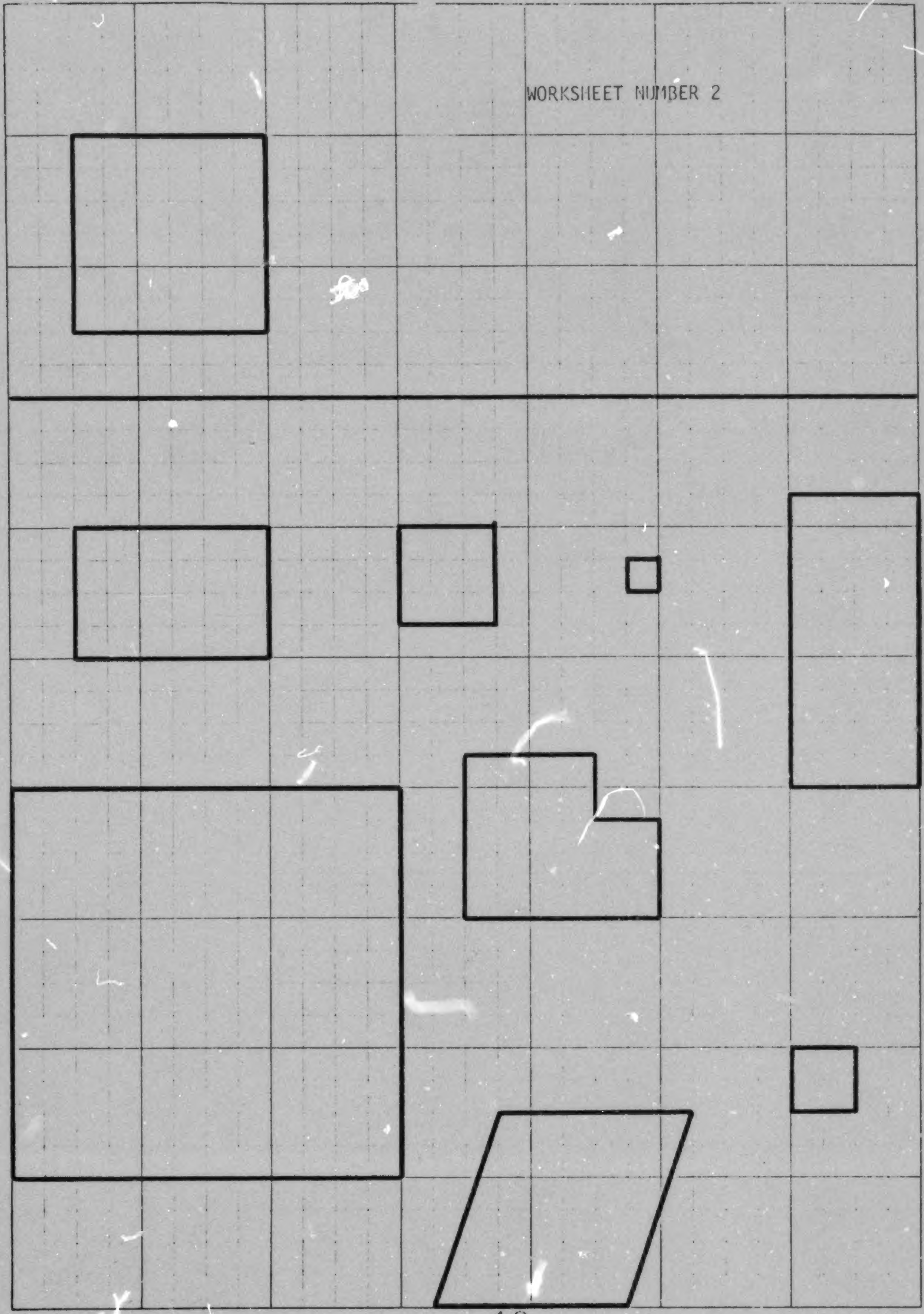


Determine which of the figures below the line are a scale drawing of the figure at the left. Then state what the scale is for these drawings.

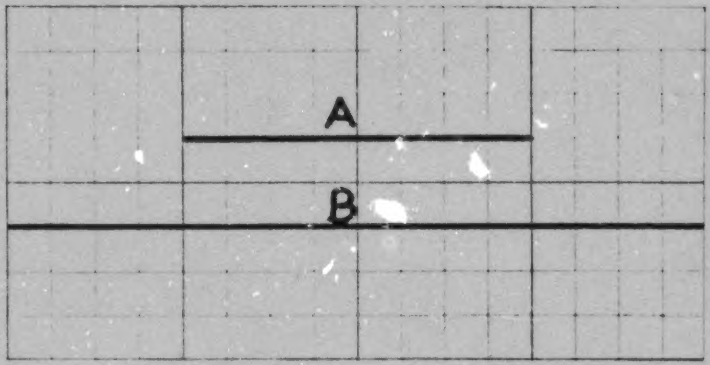

6 to 4
or 1 to $\frac{2}{3}$
6 to 10
or 1 to 1 $\frac{2}{5}$
6 to 9
or 1 to 1 $\frac{1}{2}$
6 to 3
or 1 to $\frac{1}{2}$
6 to 2
or 1 to $\frac{1}{3}$
6 to 12
or 1 to 2

Explanation
6 to 12 can be changed by dividing 6 by 6 and 12 by 6. This gives us the 1 to 2.

WORKSHEET NUMBER 2



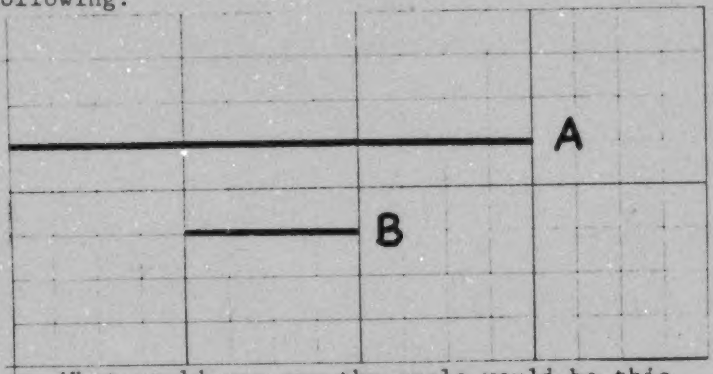
this clear.



"B" is a scale drawing of "A". Is the scale "larger" or "smaller?" It's larger, of course. "A" 2 units long or we can say that for every "Unit" in "A" there are 2 "units" in "B" or a scale of 1 to 2. Now look at the following:

LARGER!

MAKE CERTAIN EVERYONE SEES THIS COMPARISON.

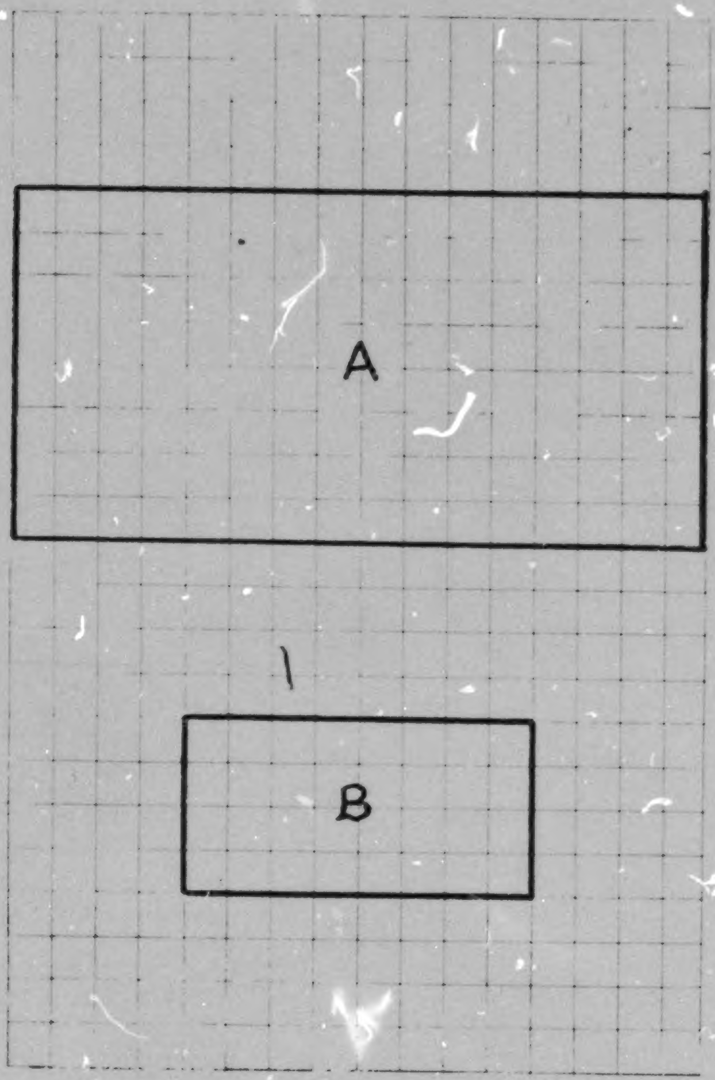


What would you say the scale would be this time? Remember its getting smaller.

Let's go for another example. In the figure that follows "B" is a scale drawing of "A".

THE SCALE IS 1 TO 3 THAT IS FOR EVERY 1 UNIT IN THE ORIGINAL THERE IS ONLY 1/3 IN THE SCALE.

What do you think the scale is for this drawing?



3. Drawing to a given scale.

Class discussion will be used to complete this lesson.

LET THE STUDENTS GIVE THE ANSWER BEFORE HAVING ANY DISCUSSION. THE SCALE IS 1 TO 1/2 OR FOR EVERY 1 UNITS IN THE ORIGINAL THERE IS 1/2 UNIT IN THE DRAWING. BE SURE THAT ALL DIMENSION MUST BE THE SAME "SCALE" TO BE A SCALE DRAWING. THAT IS, THE LENGTH IN 1 TO 1/2 AND THE WIDTH IS 1 TO 1/2.

PROJECT t/w No. 3. DECIDE THROUGH CLASS DISCUSSION WHICH OF THE FIGURES IS A "GOOD PICTURE" OF THE FIGURE ABOVE THE LINE. FOR EACH "GOOD PICTURE" STATE WHETHER IT IS LARGER OR SMALLER COPY OF THE FIGURE ABOVE THE LINE AND WHAT THE SCALE WOULD BE.

NOW CONTINUE TO DISCUSS SCALE AND POINT OUT THAT IT IS ALWAYS GIVEN IN THE FORM OF 1 TO SOME NUMBER. IF A PICTURE IS TWICE AS LARGE AS THE ORIGINAL WE WILL CALL IT A "1 to 2" COPY. IF A FIGURE IS ONE THIRD AS LARGE WE WILL CALL IT A "1 TO 1/3" COPY.

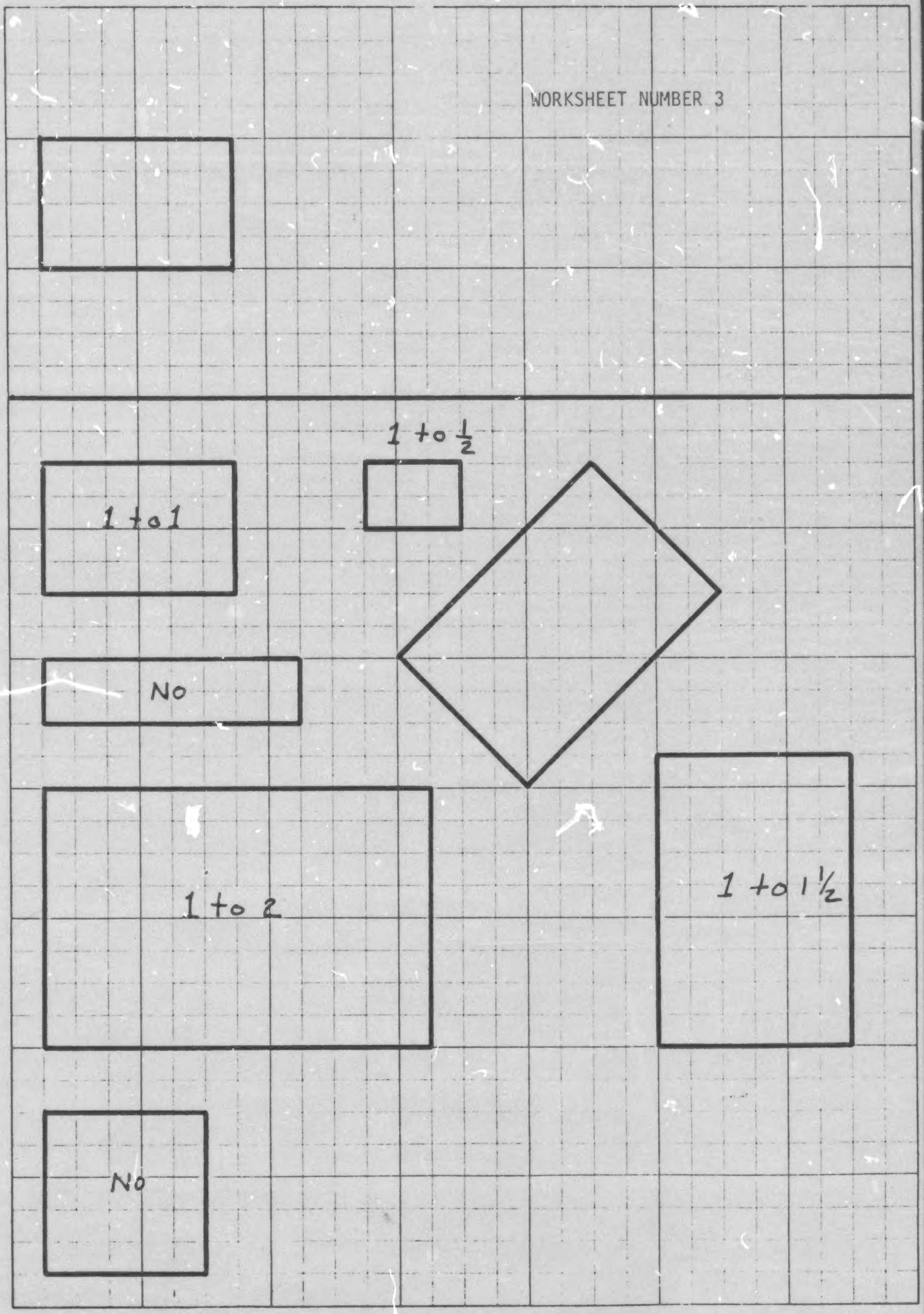
PROJECT t/w No. 4 AND CONTINUE THE SAME DISCUSSION.

AFTER WORKING SOME OF THE PROBLEMS ON WORKSHEET 3 YOU CAN POINT OUT AN EASY WAY TO FIND AND CHECK THE SCALE. YOU EXPLAIN AND DEMONSTRATE HOW YOU CAN DIVIDE THE DIMENSION OF THE ORIGINAL BY THE CORRESPONDING LENGTH OF THE SCALE DRAWING TO FIND THE SCALE. MAKE SURE THE NUMERATOR IS 1. LOOK AT YOUR ANSWER SHEET FOR EXPLANATION. HAND OUT LESSON 1.

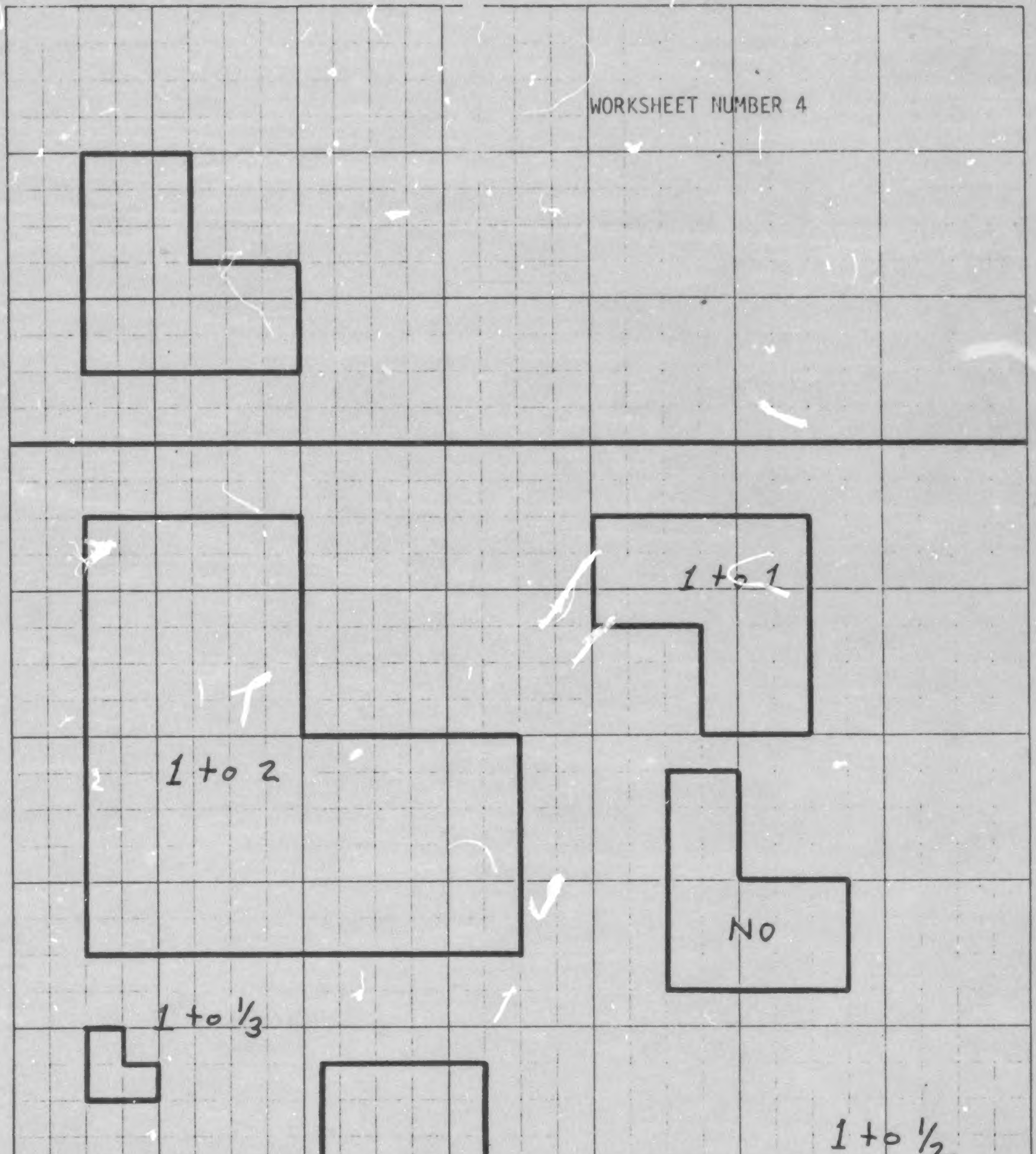
END CLASS HERE

BEFORE YOU HAND OUT THE WORKSHEETS FOR DISCUSSION? YOU CAN USE THE OVERHEAD GEOBOARD TO DEMONSTRATE HOW TO PRODUCE A SCALE FIGURE. MAKE AN ORIGINAL ON THE OVERHEAD AND THEN GIVE THE SCALE YOU ARE USING, THEN PRODUCE THE NEW FIGURE (SEE THE FOLLOWING EXAMPLE.)

WORKSHEET NUMBER 3

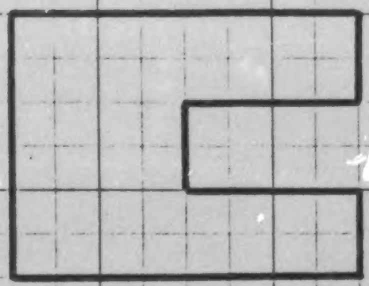

1 to 1
1 to 1/2
No
1 to 2
1 to 1 1/2
No

WORKSHEET NUMBER 4


1 to 1
1 to 2
No
1 to 1/3
1 to 1/2
No

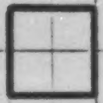
WORKSHEET NUMBER 5

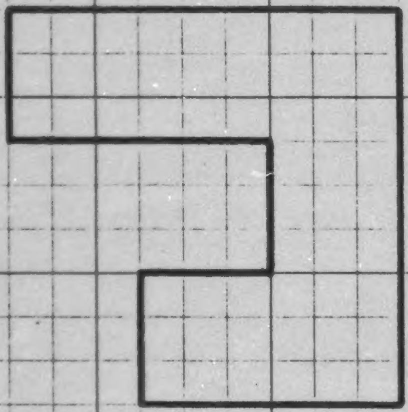
Make copies 1 to 2, 1 to 1,
1 to 1/2 and 1 to 1 1/2.

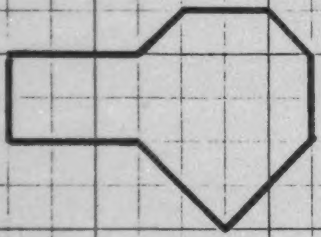


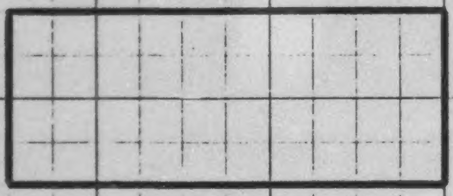
WORKSHEET NUMBER 6

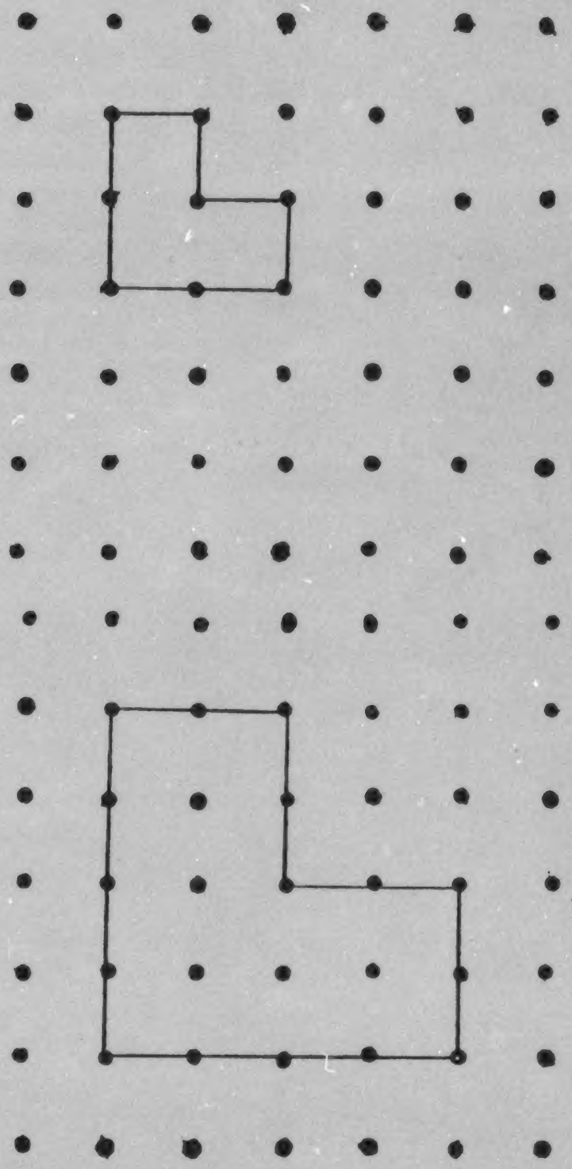
Make copies as indicated by each figure.


1 to 2


1 to 1/3


1 to 2


1 to 1/2



THIS IS A 1 TO 2 SCALE, YOU SHOULD ALSO SHOW A 1 TO 1 AND SEVERAL OTHERS BEFORE CONTINUING.

PROJECT t/w NO. 5 AND OPEN THE DISCUSSION OF HOW TO DRAW A "1 TO 2" COPY OF THIS FIGURE. THE STUDENTS MAY ATTEMPT THIS ON THEIR WORKSHEETS AND THEN USE ONE TRANSPARENCY TO SHOW WHAT THEY HAVE DONE.

ON THE SAME WORKSHEET THEY SHOULD THEN DRAW A 1 TO 1, A 1 TO 1/2 AND A 1 TO1 1/2 COPY OF THE FIGURE.

USE WORKSHEET NUMBER 6 AS AN ASSIGNMENT. YOU WILL NEED TO FURNISH THE STUDENTS WITH 1/4" GRID PAPER FOR THIS ACTIVITY.

END CLASS HERE

---

4. Exploration

THE STUDENTS ARE TO DRAW FIGURES AND/OR DESIGNS AND THEN PRODUCE LARGER AND SMALLER SCALE COPIES OF THE FIGURE OR DESIGN. CREATIVITY AND ARTISTIC EXPRESSION SHOULD BE ENCOURAGED, AND SAMPLES AND STUDENTS' WORK POSTED.

USE THE FIRST PART OF THE PERIOD TO DISCUSS THE PREVIOUS ASSIGNMENT. THE REMAINING TIME IN THE PERIOD SHOULD BE USED FOR THIS ASSIGNMENT.

5. Summary & Review

THIS LESSON MAY TAKE MORE THAN ONE PERIOD. IT IS A SUMMARY OF AND REVIEW OF MEASUREMENT, AREA, AND SCALE DRAWING. IT MAY BE NECESSARY FOR YOU TO MAKE-UP ADDITIONAL ASSIGNMENTS TO SUPPLEMENT IN THE STUDENTS LACK OF UNDERSTANDING. MAKE A COPY OF REVIEW ASSIGNMENT FOR EACH OF THE STUDENTS AND PROCEED AS FOLLOWS.

WORK EACH PROBLEM IN THE FOLLOWING WAY: READ THE PROBLEM OR CALL STUDENTS ATTENTION TO PROBLEM AND DRAWINGS, IF ANY. HAVE EACH STUDENT WRITE HIS ANSWER AS DIRECTED ON THE SHEET. DISCUSS VARIOUS ANSWERS IDENTIFY THE CORRECT ANSWER AND HOW IT WAS OBTAINED. AT THE END OF THE CLASS PERIOD COLLECT ALL REVIEW SHEETS. THERE IS NO NEED TO GRADE THESE SHEETS BUT THEY SHOULD BE CHECKED TO INSURE THAT EACH STUDENT IS FOLLOWING THE REVIEW AND TRYING EACH PROBLEM.

END CLASS HERE

APPENDIX

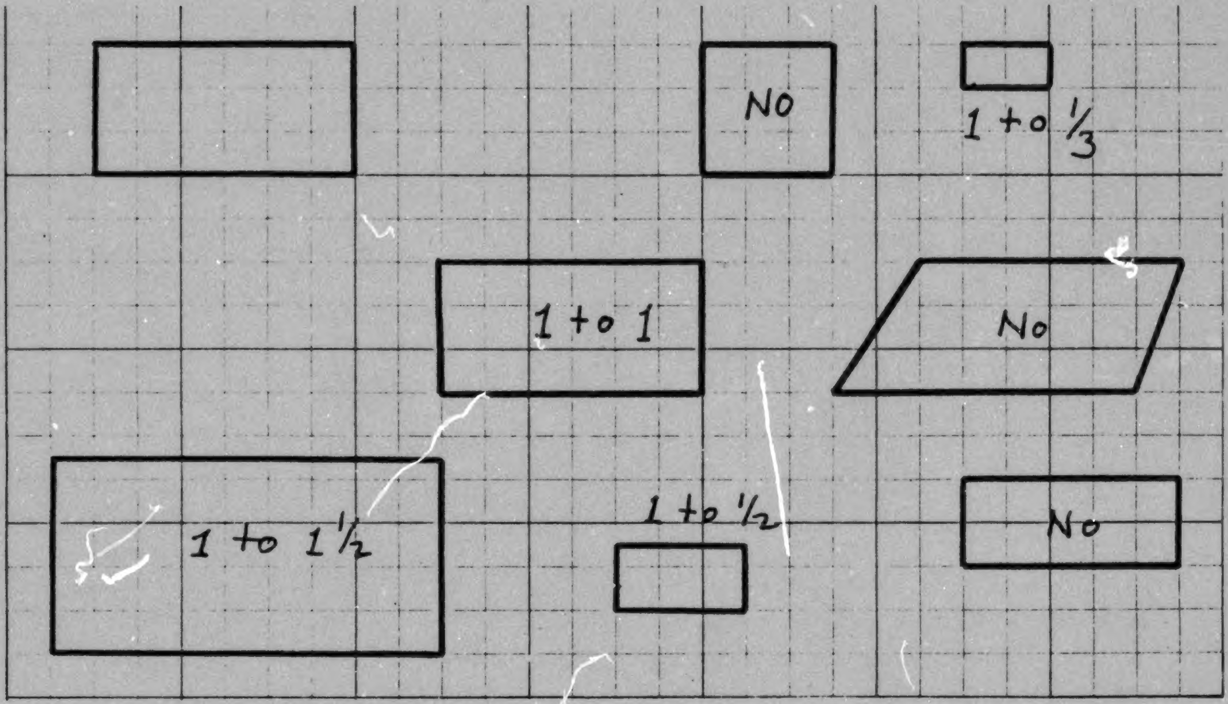
Review Lesson

1. Use a ruler to measure the lengths of each of these lines.

nearest in. 5 ; nearest 1/2 in. 4 1/2 ; nearest 1/4 in. 4 3/4

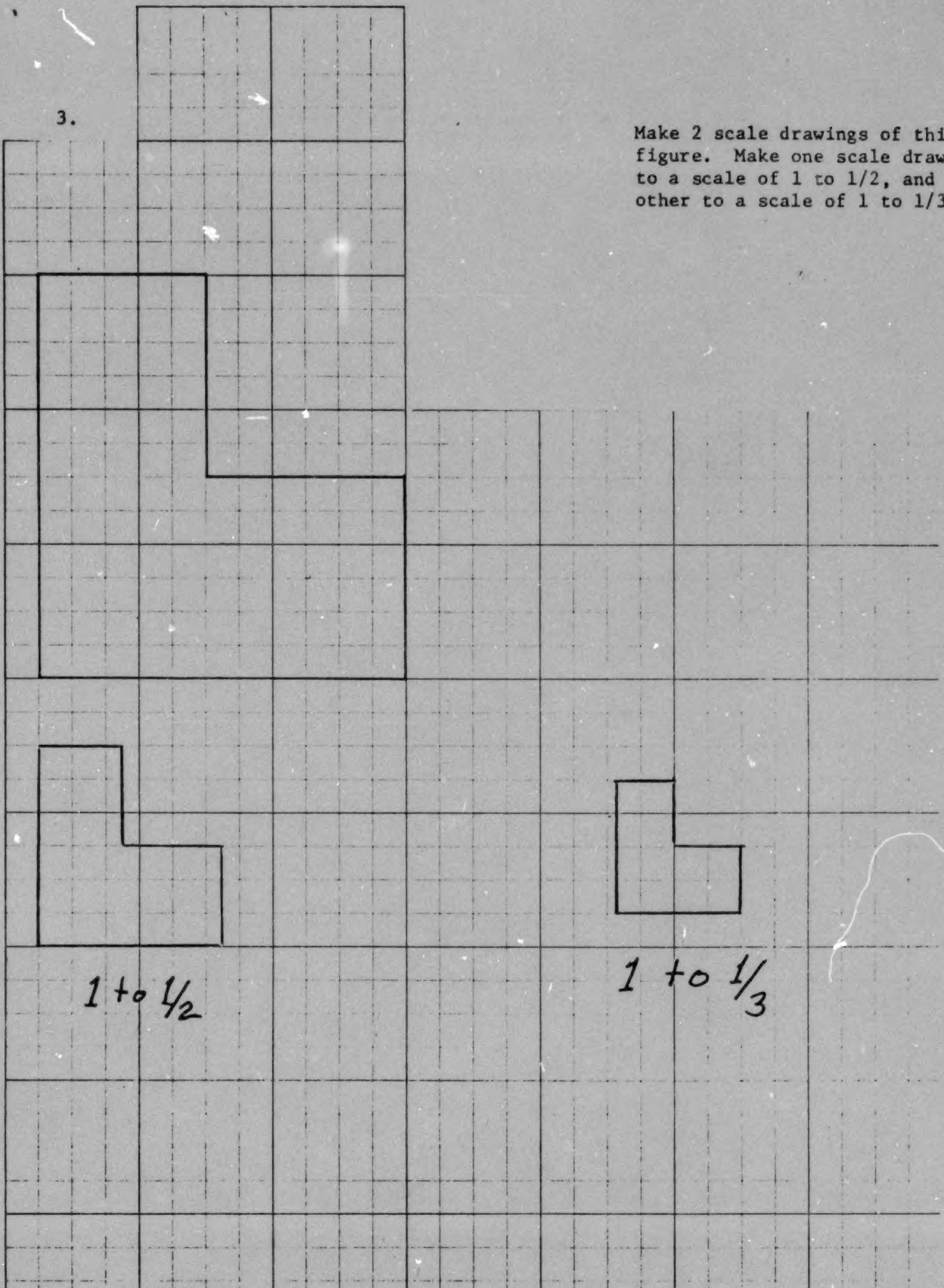
Nearest in. 5 ; nearest 1/2 in. 5 ; nearest 1/4 in. 5 1/4

2. Which of the figures are "scale drawings" of figure A? What is the scale in each case?

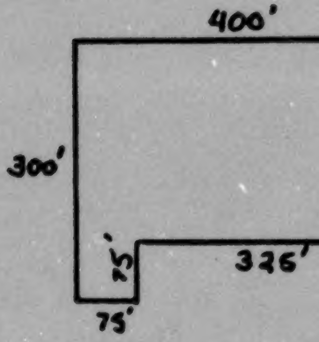

No
1 to 1/3
1 to 1
No
1 to 1 1/2
1 to 1/2
No

3.

Make 2 scale drawings of this figure. Make one scale drawing to a scale of 1 to 1/2, and the other to a scale of 1 to 1/3.



4. A land developer made these measurements on an irregular plot of ground.


400'
225'
300'
325'
75'
75'

In a scale drawing he draws the 400 foot side 16 inches long. What scale is he using?

1 inch = 25 feet

How long will the other lines in his drawing be?

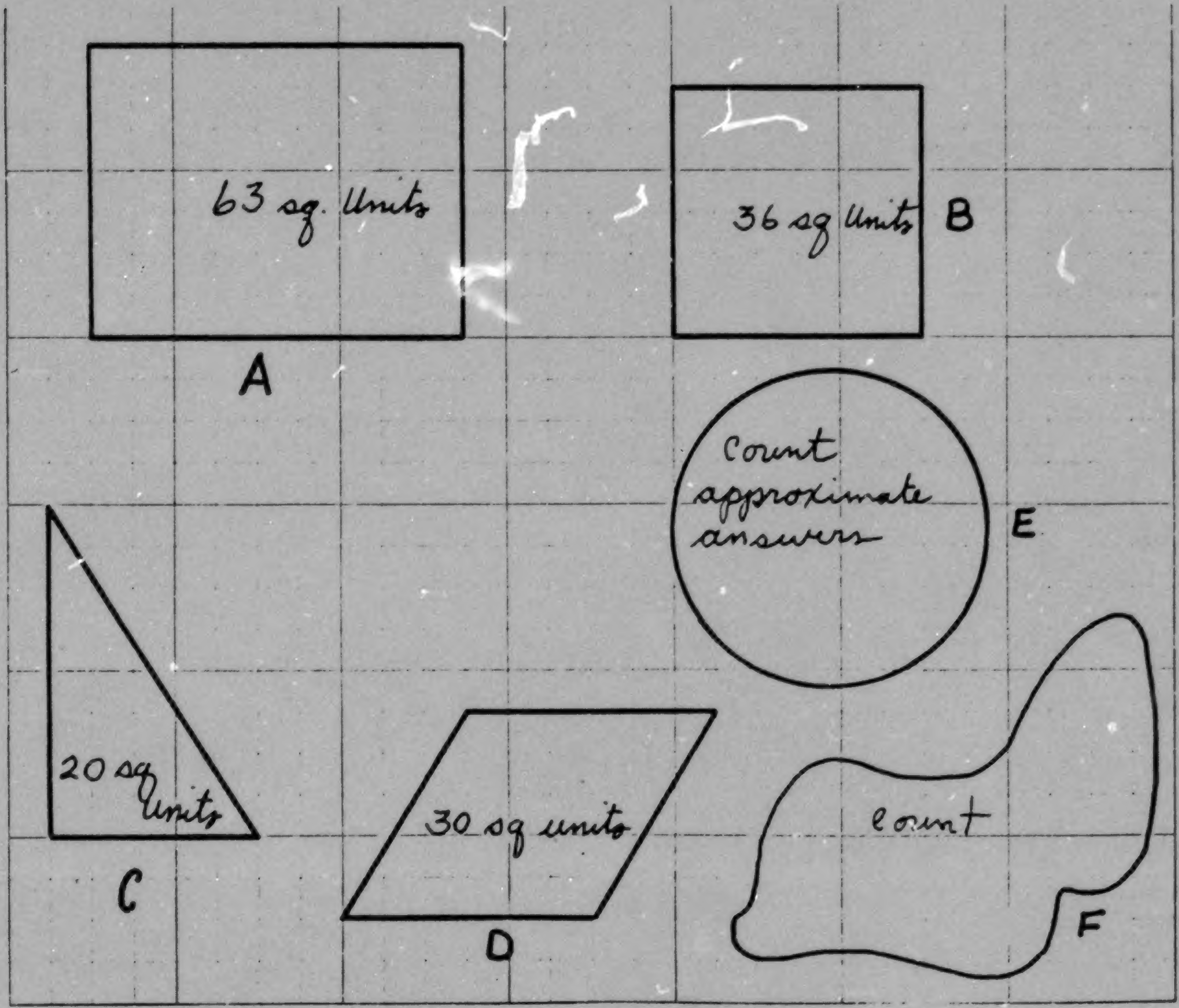
325 feet = 13 inches

225 feet = 9 inches

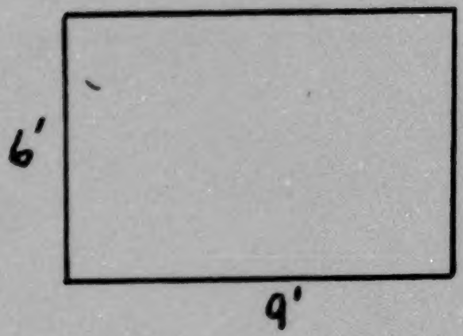
300 feet = 12 inches

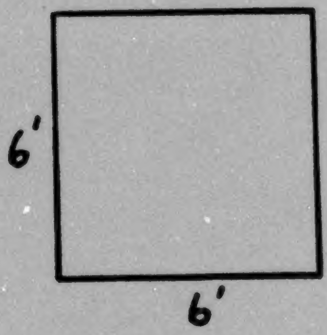
75 feet = 3 inches

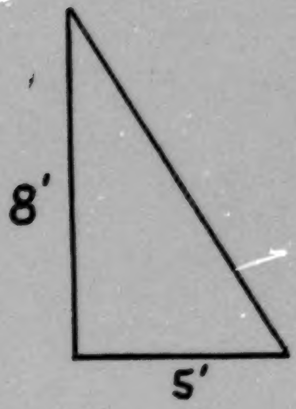
5. What is the area of each of these figures?

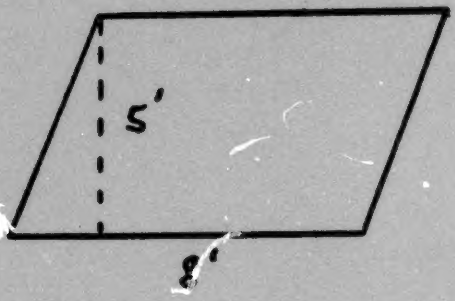

63 sq. Units
A
36 sq Units
B
Count approximate answers
E
20 sq Units
C
30 sq units
D
count
F

6. What is the area of each of these figures?









SUGGESTED OPTIONAL ACTIVITIES

Topic: Layout and Construction

Activity 1.

Objectives:

The students will divide into groups of 3 to 6; the groups will meet to plan their construction project.

Materials:

Notebook paper and pencils.

Procedure:

Begin with a talk on the place of this project in the unit. Emphasize that this project is like a real job and uses their previous learning in the unit. Stress the importance of mature cooperation in the work to be done. Students should be encouraged to form groups in which they will work well, not necessarily with thier best friends.

Hand out the Project Organization Sheet to all students and go over the things they must do. Each student should keep his Project Organization Sheet for the time the project runs.

Now direct the students to form groups. You observe the groups as they form and sit with the group you judge will have the greatest difficulty getting organized. When they are organized and working, move to other groups to assist them. Remember, this project is to be the students' own; they must provide the leadership and effort. Expect some to do more than others but be firm with students who are not participating. Encourage student leadership.

Students should use the remainder of the period to measure the thing they are going to build and to record the measurements on a rough drawing in preparation for making a scale drawing.

Assignment:

Get the measurements needed to make scale drawings for the project.

Class Periods 2, 3, and 4. (More or fewer days at the discression of the teacher.)

Objective:

To complete the scale drawing and collect the material for construction.

Materials:

When the studetns have planned the construction, they should have a good idea of the material they need and should be collecting it.

Procedure:

Each class period should start with a short group meeting. Topics to be discussed are (1) What materials have been obtained; what still needs to be collected, (2) How are the scale drawings coming (What needs to be done today.

Then the group members begin whatever tasks they have to do. You should circulate around the room. Particularly, talk with students who are not participating. A student who really does not have anything to do on the project may study.

When a group is finished with the scale drawings you should check them and approve them for construction. If the scale drawings are not correct or not adequate they should be done correctly before construction begins.

Class Periods 5, 6, 7, 8, 9, 10. (More or fewer days at the discression of the teacher.)

Objective:

To construct a scale model based on the scale drawings just completed.

Materials:

Each group will have its own list of materials and should have collected them.

Procedure:

Permit groups to work at their own pace. Encourage creativity and freedom of expression.

This is the last activity in this unit. Try to arrange for public display of these projects and the scale drawings.

Topic: Scale Drawing

Activity 2.

Problem: Make scale drawing of the school yard.

Procedure: Work in teams of 2 or 4. Locate the boundaries of the school yard. Pick a scale. Go from one corner to the next. Each time shoot angles to key points. One member of your team can go to the next corner with a pole so you can sight him. Measure the distances and draw them to scale.

Activity 3.

Problem: Plan a sprinkling water system for the school yard.

Procedure: Make a scale sketch of the school yard (see Job Cards 5 and 6A). Plan the location of the water pipes which will be buried in the ground and determine where to place sprinklers. Calculate how many feet of water pipe you will need.

Activity 4.

Problem: Plan a swimming pool.

Procedure: Locate a good spot for a swimming pool. Make a scale drawing of the pool and calculate how much room it will take. Make sure it will fit.

PROJECT ORGANIZATION SHEET

Group members:

____

____

____

____

____________ ______________

Construction Project

1) Trailer
2) Classroom
3) Steel frame building
4) Small house
5) Other ____________________
____
____

(Select one)

Steps in construction:

1) Collect measurements of the real thing.
2) Decide on a scale. What scale will your group use? ________________
3) Make scale drawings (note need for floor, all exterior and interior walls, roof).
5) Decide on material to be used to construct model; obtain material.
6) Assign exterior construction, interior construction and detail to group members.
7) Begin construction.

TEACHER'S MANUAL

APPRENTICESHIP: LEARNING TO BE A CEMENT MASON

General Instructions

1. Use of outside speakers and field trips. Schools and teachers differ in the degree to which they can use speakers and take students from the school on field trips. For this reason the unit is "self contained." However, here are some suggestions for interesting activities which will contribute materially to the unit.

A. Contact a union local. Ask for a speaker on apprentice programs. The Plasterers and Cement Mason's Union would be most appropriate.

B. Have a journeyman cement mason speak to the class on his occupation.

C. Visit a construction site where cement work is being done or visit a readi-mix cement plant. Be sure to have prior approval for this activity and have someone available who can explain what's going on!

2. The "read it in class" feature. The students pages are presented as a connected narrative. Problems grow out of the narrative. This story is to be read in class and, as problems come up, the students stop and work these out. Each day normally will end with a problem set. There are also discussion questions within the story and these should be treated during class time as described in item 3 below. This "read it in class" procedure should be used to contribute to the students growth in reading skill, also.

The narrative is designed to bring up mathematical problems as they might arise on the job, to foster desirable attitudes toward employment, to present realistic employment information, and to give the students a focus for discussion of questions related to careers.

3. The "discussion question" feature. There are a number of questions for discussion. These are marked by an x on the dividing line. These questions point up ideas related to mathematics, and careers. When you reach each such question spend some time getting students to think and tell their ideas and opinions.

4. The "Daily Problem" feature. Almost every day a verbal problem or "story problem" will be encountered in the material. This contact with verbal problems on a daily basis will help to overcome students fe[illegible] and dislike of such problems. Time should be taken in class for (1) students to work independently on the problem and (2) for group discussion and

presentation of various solutions.

5. *The "It's a Rip Off" feature*. Many students enjoy puzzles and problems of a mathematical nature. They may enjoy this aspect of mathematics *more* than the regular class work. A problem such as that is presented every two or three days, located at the bottom of the page so the student can "rip it off" and take it home. Class time should be spent on these problems *after* students have worked on them, taking about one half hour for each such problem.

6. *General Review of Underlying Mathematical Processes*. (GRUMP). Grump's are short computational assignments given several times each week to prevent forgetting of computational skills.

7. *Mission Incredible Assignments*. When an assignment involves work outside the school or when only one or two students are needed to do an assignment, such as constructing a demonstration, the assignment is optional for extra credit. It is frequently important to have at least one student do each of these assignments because the information collected or the demonstration constructed will contribute to the class activities.

Materials Needed

Lessons 3 and 10: 200 1 inch cubical counting blocks.

Lesson 4: Scissors and transparent tape. (10 of each)

Lesson 6: Scissors and transparent tape (10 of each) and a volume demonstration set with water or sand.

Apprenticeship: Learning To Be A Cement Mason

1. Apprentice Program

Sam Jackson wanted to enter the building trades and thought he would do well in cement work. He liked outdoor work and he had done some cement work with his father and enjoyed it. How important is it to like the work you do? Do many people you know like their work? How does "liking the job" compare in importance to the pay from that job?

* ENCOURAGE THE STUDENTS TO DISCUSS THESE QUESTIONS.

He learned that a journeyman cement mason working in Atlanta earned $7.35 per hour. An apprentice earns $3.67 per hour to start and advances as follows:

FIGURE APPROXIMATELY CORRECT FOR SKILLED CONSTRUCTION WORKERS, FEBRUARY 1974.

Time on Job	%	Hourly Rate
0-6 Months	50%	$3.67
6-12 Months	55%	4.04
1-1 1/2 Years	65%	4.78
1 1/2 - 2 Years	75%	5.51
2 - 2 1/2 Years	85%	6.25
2 1/2 - 3 Years	95%	6.98
3 or More Years	100%	$7.35

AGAIN, THESE FIGURES ARE ACCURATE FOR CEMENT MASONS AND PLASTERERS.

Complete the table. The percent figure is the percent of the pay of a journeyman cement mason, $7.35 per hour.

ALLOW 10 MINUTES FOR THE STUDENTS TO WORK. REVIEW PERCENT IF NECESSARY.

Sam found out that there is a waiting list for entry into the Plasterers and Cement Mason's Union Apprenticeship program. He wrote for information and had his name put on the list. He would receive $50.00 per week for 6 weeks while going to apprentice school and then go through 3 years of "OJT," On the Job Training, at the pay scale shown above.

WHY WOULD THE UNION PAY APPRENTICES? PROBABLY TO ATTRACT GOOD WORKERS TO THE TRADE.

Would you do what Sam is going to do? What are the advantages and disadvantages? What is the purpose of an apprentice program?

* ENCOURAGE THE STUDENTS TO DISCUSS THESE QUESTIONS. APPRENTICESHIP IS AN AVENUE TO ENTER MANY TRADES. STUDENTS SHOULD KNOW ABOUT THIS POSSIBILITY.

END CLASS HERE

2. Constructing Cement Forms

Sam began his first day of "OJT," On the Job Training, with a small cement contractor. He worked alongside the owner and a journeyman cement mason. A "journeyman" is a skilled worker who has completed training for his trade. The contractor was himself a journeyman mason.

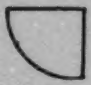
The job they were doing was to pour a driveway and the slab for a garage. The blue print looked like the next page. Convert the dimensions given on the blue print to feet. The scale is 1 inch = 16 feet.

GIVE THE STUDENTS TIME TO CALCULATE HERE. REVIEW IF NECESSARY THE WORK ON SCALE AND USING THE SCALE TO FIND A LENGTH.

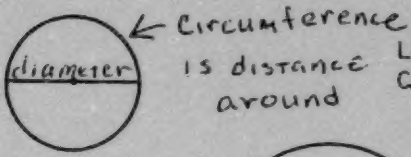
Sam was to figure how much wood they needed to construct the forms. They would need to form up the drive, the garage and the extra circula part separately. The "perimeter" of a shape is the distance around it. Calculate the perimeter of the driveway and the garage.

GIVE THE STUDENTS TIME TO WORK.
GARAGE: 80 FOOT PERIMETER
DRIVE: 176 FOOT PERIMETER

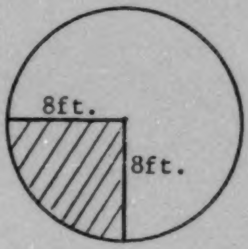
Now calculate the perimeter of this part: It is part of a circle. What is the distance around a circle? The circumference (distance around) a circle is close to 3.14 times the diameter. The diameter is 16 FT., so the circumference is 50.24 FEET. However, only 1/4 of that is actually part of the job because that piece is a quarter circle. Now, what is the perimeter of that part?



YOU WILL HAVE TO DO SOME CAREFUL TEACHING HERE.



LEAD THE STUDENTS THROUGH CALCULATIONS HERE.



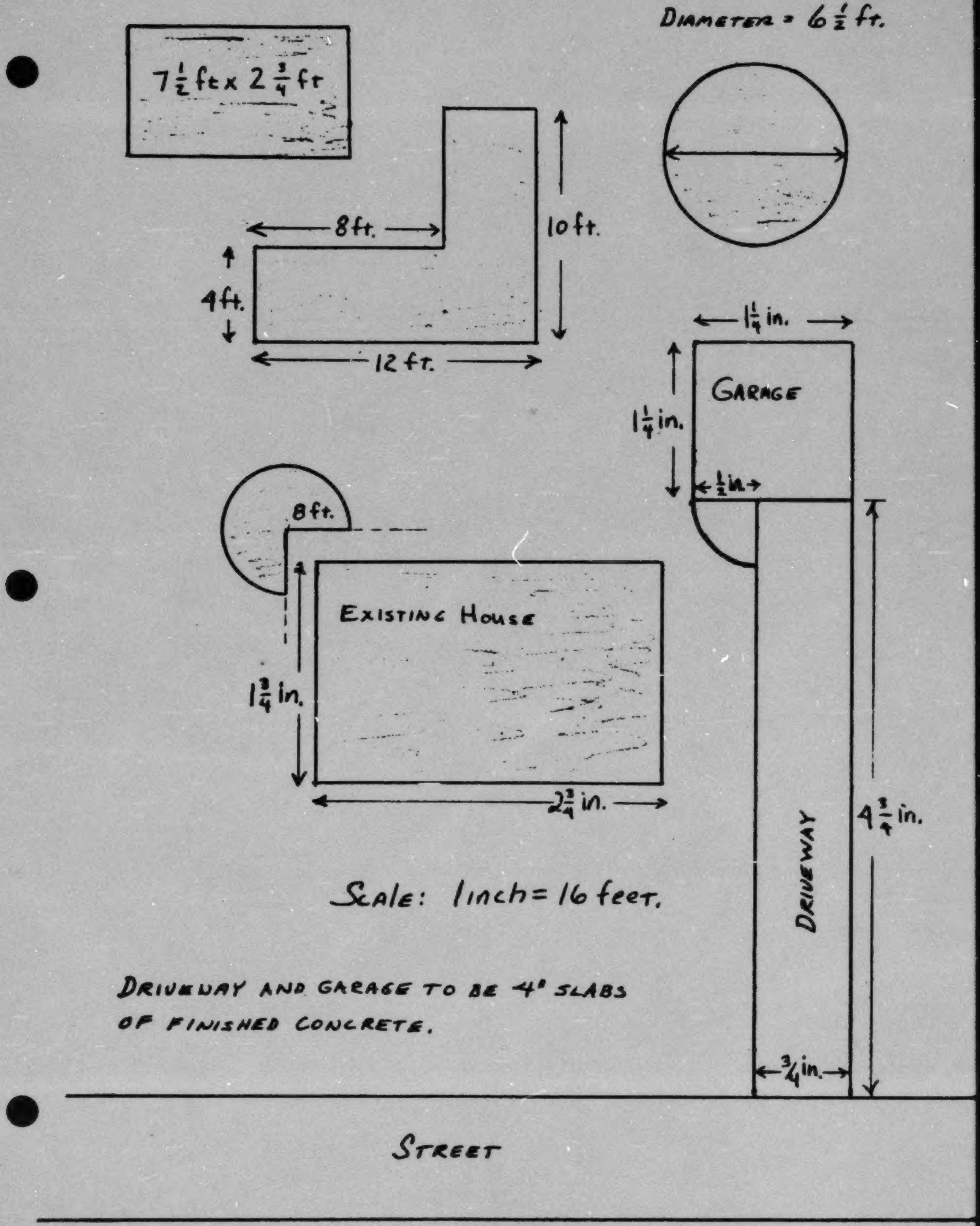
WHEN YOU GET HERE, LET THE STUDENTS WORK FOR A WHILE TO TRY TO FIND THE FINAL ANSWER.

PERIMETER OF IS

8 FEET + 8 FEET + 12.56 FEET = 28.56 FEET.

Now, find the perimeter of the shaded figures on the blue print.

END CLASS HERE


Diameter = 6½ ft.
7½ ft x 2¾ ft
8 ft.
10 ft.
4 ft.
12 ft.
1¼ in.
Garage
1¼ in.
½ in
8 ft.
Existing House
1¾ in.
2¾ in.
Driveway
4¾ in.
¾ in.
Street

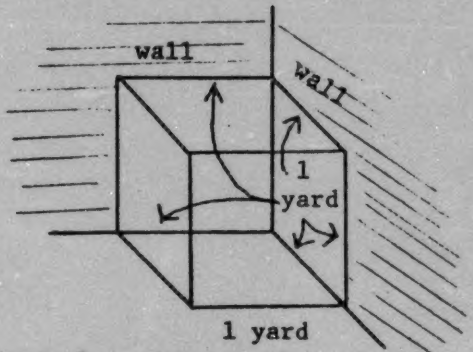
Scale: 1 inch = 16 feet.

Driveway and garage to be 4" slabs of finished concrete.

MISSION INCREDIBLE:

This is your mission, should you choose to accept it. Phone your local cement dealer, the people who have the "cement mixer trucks." Ask them how they sell concrete and the cost of concrete. Go to a local hardware or building supply store where they sell "sacrete" products and find the cost of a sack of concrete mix. How much concrete will one sack make? Bring this information back to class.

Most concrete company sell concrete by the "yard" meaning one cubic yard. Construct, in one corner of the classroom a "cubic yard." It is a cube which is one yard long, wide and high.



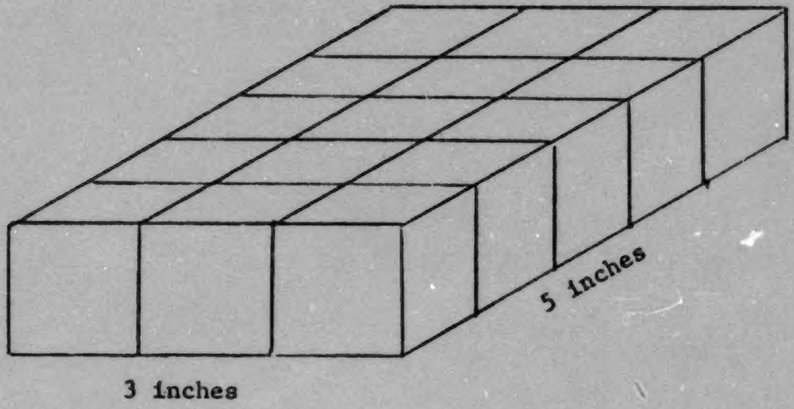
Call a cement work contractor or a general contractor and ask him how much a cement finisher charges to finish a driveway. Many charge "by the foot." What does that mean?

3. Volume: Dimensions in the same units

When the forms were set, the contractor decided that there was time to pour the slab for the garage. Sam was to figure how much cement, in cubic yards, was needed to pour the slab. Sam needed to review the way to find the volume of an object. Let's look at an object 3 inches wide, 5 inches long and 4 inches high.

MATERIALS:
A BOX OF 100 ONE INCH CUBICAL COUNTING BLOCKS.

MAKE THIS ON YOUR DESK, USING THE INCH CUBES, STARTING WITH THE FIRST LAYER.

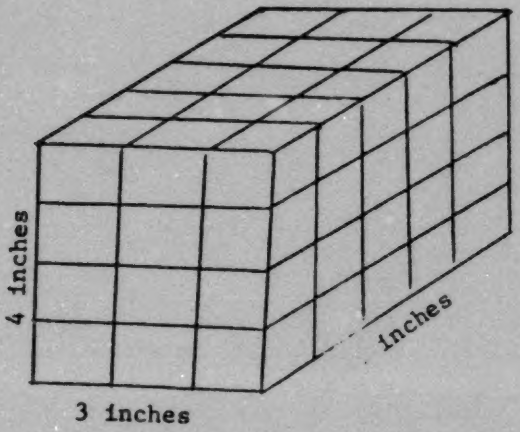


RELATE THE PICTURE AND THE FIRST LAYER OF BLOCKS ON YOUR DESK.

How many "cubic inches" are in this first layer?
How can you find this?

15 CUBIC INCHES

BY COUNTING WOULD BE ONE WAY BUT MULTIPLYING 3 X 5 IS BETTER.



How many blocks are in each layer? How many blocks are in all four layers? How can you find the number of blocks in the whole shape?

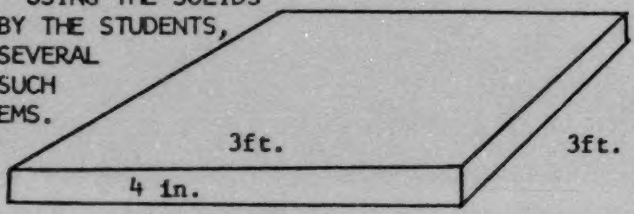
Problems: Find the number of cubic units in each of these shapes.

	Length	Width	Height	Volume
1.	7 in.	4 in.	6 in.	168 CU.IN.
2.	12 in.	5 in.	8 in.	480 CU.IN.
3.	6 in.	6 in.	15 in.	540 CU.IN.
4.	8 1/2ft.	5 1/2ft.	4 ft.	187 CU.FT.
5.	6 2/3ft.	1 1/2ft.	8 ft.	80 CU.FT.
6.	12 3/4ft.	5 ft.	1/2 ft.	$37\frac{7}{8}$ CU.FT.
7.	2 1/5 ft.	1 3/4ft.	8 ft.	$30\frac{4}{5}$ CU.FT.
8.	13.2 in.	5.1 in.	7.4 in.	498.168 CU.IN.
9.	18.5 in.	6.2 in.	5.7 in.	653.79 CU.IN.
10.	8.4 in.	3.5 in.	.5 in.	14.7 CU.IN.

4. Dimensions in volume: mixed units.

Now, let's look at some problems like the slab of cement. Most of the time a slab of cement will be given, length and width in feet, depth in inches, and the volume needed in cubic yards. Remove the last page from this unit cut out the figure and fold it up and tape it as the teacher directs. This is how a slab of cement 1 yard x 1 yard x 4 inches would actually look.

NOTE: USING THE SOLIDS MADE BY THE STUDENTS, WORK SEVERAL MORE SUCH PROBLEMS. LEAVE THEM ON A TABLE FOR STUDENTS TO USE IF THEY WISH



3 X 15 BLOCKS IN EACH LAYER. 4 LAYERS SO 15 X 4 = 60 BLOCKS IN THE WHOLE THING.

3 X 5 X 4 = 60
LENGTH X WIDTH X HEIGHT = VOLUME OR V = L X W X H.

DO SEVERAL MORE EXAMPLES USING THE CUBICAL BLOCKS TO ILLUSTRA THIS PRINCIPLE.
BEFORE WORKING THE PROBLEM, EMPHASIZE THE UNIT OF THE ANSW CUBIC INCHES, FEET, YARDS, ETC.

END CLASS HERE

WHEN THE STUDENTS HAVE FINISHE THESE COLLECT 16 OF THEM. ON YOUR DESK MAKE A SQUARE OF THE 16 SOLIDS. EXPLAIN THAT THIS SHOWS A 12 FT. X 12 FT. SLAB, 4 IN. THICK:

STOCK 9 TO SHOW 1 CUBIC YARD AND THE REMAINING 7 MAKE "ALMO ANOTHER CUBIC YARD. ASK "HOW MANY CUBIC YARDS OF CEMENT IN THIS SLAB?" ANSWER: ALMOST 2, EXACTLY 1 7/9 CUBIC YARDS.

Sam had to work this problem without a model of the slab. He said:

$$V = l \times w \times h$$
$$= 12 \text{ ft.} \times 12 \text{ ft.} \times 4 \text{ in.}$$
$$= 4 \text{ yds.} \times 4 \text{ yds.} \times \frac{1}{9} \text{ yard}$$
$$= \frac{16}{9} \text{ cubic yards}$$
$$= 1\frac{7}{9} \text{ cubic yards}$$

IN WORKING PROBLEMS LIKE THIS WE (1) WRITE THE FORMULA, (2) FILL IN THE GIVEN DIMENSIONS, (3) CONVERT TO YARDS AND (4) MULTIPLY.

Problems. Find the volume in cubic yards of each of these slabs. Follow the form above. Construct these shapes from the solids you made if you want.

	l	w	h	Vol.
1.	12 ft.	9 ft.	4 in.	1 1/3 CU.YDS.
2.	15 ft.	6 ft.	6 in.	1 2/3 CU.YDS.
3.	30 ft.	12 ft.	4 in.	4 4/9 CU.YDS.
4.	$22\frac{1}{2}$ ft.	12 ft.	6 in.	5 CU.YDS.
5.	51 ft.	36 ft.	9 in.	153 CU.YDS.
6.	12 ft.	10 ft.	4 in.	1 13/27 CU.YDS.
7.	28 ft.	15 ft.	6 in.	7 14/18 CU.YDS.
8.	120 ft.	84 ft.	9 in.	280 CU.YDS.

AT THE BEGINNING OF TOMORROW'S LESSON IT MIGHT BE A GOOD IDEA TO DISCUSS THE "REALITY" OF THESE ANSWERS. CEMENT MASONS WOULD NEVER ASK FOR 1 13/27 CUBIC YARDS. THEY WOULD ALSO RATHER BE LONG THAN SHORT ON AN ORDER.

END CLASS HERE

5. Cost of Concrete

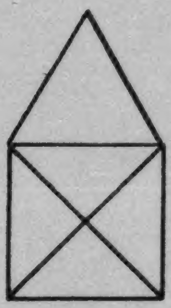
Sam was ready now to find out how many "yards" of concrete would be needed for the floor of the garage. The garage is 20 ft. x 20 ft. and 4 inches thick. Find the number of cubic yards required.

V = L X W X H
= 20 FT. X 20 FT. X 4 IN.
= 6 2/3 YDS. X 6 2/3 YDS. X 1/9 YD.
= 4 76/81 CUBIC YARDS.

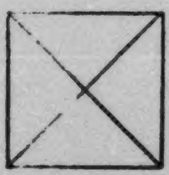
GIVE THE STUDENTS TIME TO WORK THIS OUT.

It's A Rip Off

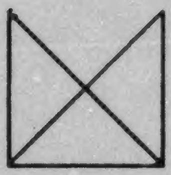
Drawing a figure without lifting your pencil or tracing over a line you have drawn is easy sometimes ... and hard sometimes.



(Easy)



(Hard)



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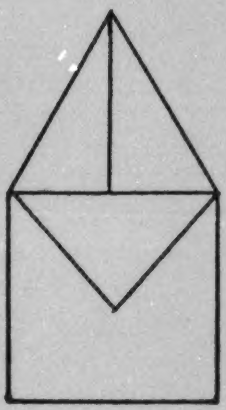


(?)

Sam's calculations gave him the "exact" answer, but, to be safe, he should order a little more than he needs. Why?

If you were Sam, how much concrete would you order? ______________________________

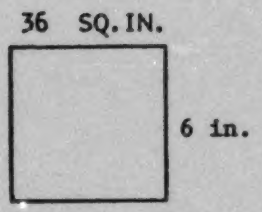
How much would that much concrete cost? You may use the cost per cubic yard which the local concrete companies charge or ask your teacher for a cost figure.

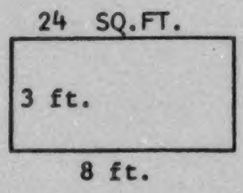
For each of the concrete shapes (problems 1-8 in the last lesson) find the volume of concrete you would order and the cost. Use whatever price you have been using.

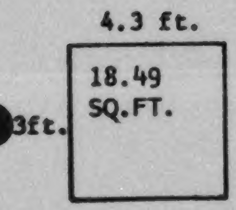
	Vol.	Order Vol.	Cost
1.	1 1/3CU.YD.	1 1/2 CU.YD.	$33.53
2.	1 2/3CU.YD.	2	44.70
3.	4 4/9CU.YD.	5	111.75
4.	5 CU.YD.	5 1/2	122.93
5.	153 CU.YD.	160	3,576.00
6.	1 13/27CU.YD.	2	44.70
7.	7 14/18CU.YD.	8	178.80
8.	280	290	6,481.50

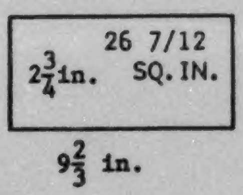
6. **Review of Area Formulas.**

Find the areas of these figures.









YOU CAN ALWAYS THROW A LITTLE AWAY BUT IF YOU ARE SHORT THE JOB MAY BE RUINED.

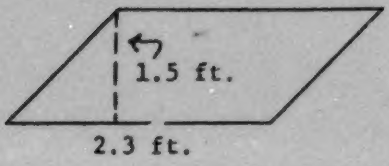
5 YARDS WOULD BE VERY CLOSE, 5 1/2 PROBABLY BETTER, 6 MOST LIKELY TOO MUCH. HOWEVER, NO "HARD AND FAST" RULE MAKES ONE ANSWER RIGHT OR WRONG.

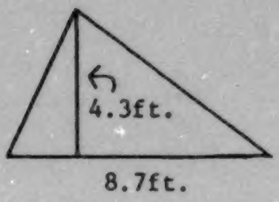
$22.35 PER CUBIC YARD OR USE THE LOCAL COST. GIVE THE STUDENTS TIME TO FIGURE.

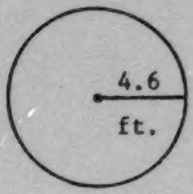
THE "VOL." COLUMN SHOULD BE TAKEN FROM THE LAST LESSON. IT NEED NOT BE RECOMPUTED. THE "ORDER VOL." IS THE NUMBER OF YARDS TO BE ORDERED. ANSWERS MAY BE DIFFERENT AS THIS IS AN ESTIMATE. THE COST FIGURES ARE COMPUTED USING $22.35 PER YARD AND THE "ORDER VOL." IN THE TABLE.

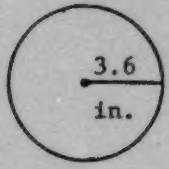
END CLASS HERE

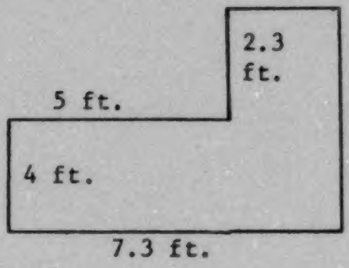
BEFORE ASSIGNING THESE PROBLEMS TO THE STUDENTS, REVIEW THE FORMULAS FOR AREA OF:
SQUARE: $A = s^2$
RECTANGLE: $A = l \times w$
TRIANGLE: $A = 1/2bh$
PARALLELOGRAM: $A = bh$
CIRCLE: $A = \pi r^2 \pi$
DISTINGUISH "HEIGHT" OF A FIGURE AS THE HEIGHT MEASURED PERPENDICULAR TO THE BASE. SHOW HOW COMPLEX FIGURES MAY BE BROKEN INTO SIMPLE PARTS AND THE AREAS ADDED. ANGLES SHOWN WHICH LOOK LIKE RIGHT ANGLES MAY BE ASSUMED TO BE RIGHT ANGLES. EMPHASIZE SQUARE UNIT.

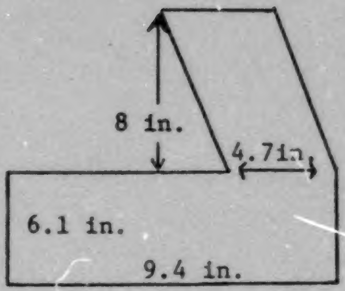


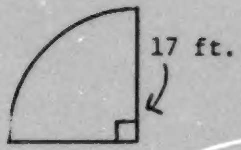







2.3
ft.
5 ft.
4 ft.
7.3 ft.

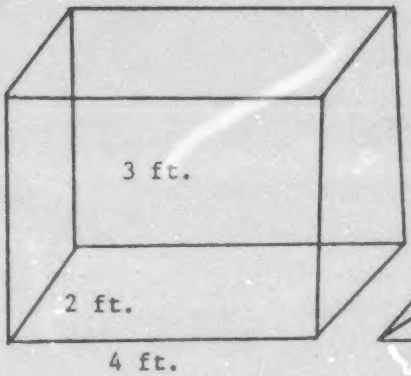

8 in.
4.7in.
6.1 in.
9.4 in.



7. Three Volume Formulas.

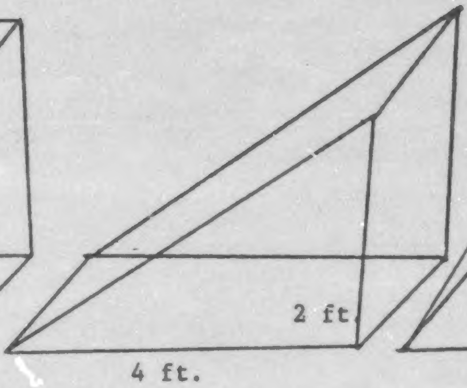
Carefully take the last 3 pages from this unit and construct the models on th pages. There are three different, but related volume formulas for these 3 shapes.

#1



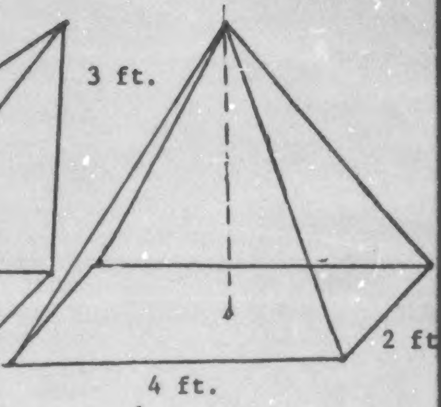
V = A x h

#2



$V = \frac{1}{2} \times A \times h$

#3



$V = \frac{1}{3} \times A \times h$

In each case the volume is found using the area of the base and the height. If the figure is a "rectangular solid" the volume is area x height. If the figure rises from a base to a line, shaped like a wedge, the volume is $\frac{1}{2}$ x Area x height. If the figure rises to a point, the volume is $\frac{1}{3}$ x Area x height. Calculate the volume of each of these three models you have constructed.

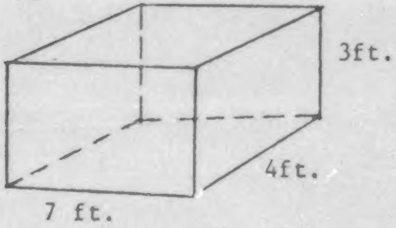
1. V = A x h = 8 SQ.FT. x 3 FT. = 24 CU.FT.

2. $V = \frac{1}{2} \times A \times h$ = 1/2 x 8 SQ.FT. x 3 FT. = 12 CU.FT.

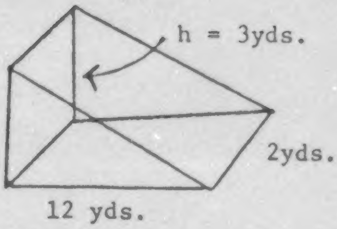
3. $V = \frac{1}{3} \times A \times h$ = 1/3 x 8 SQ.FT. x 3 FT. = 8 CU.FT.

Find the volume of each of these. First choose the proper formula.

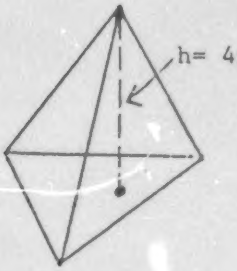
#1



#4

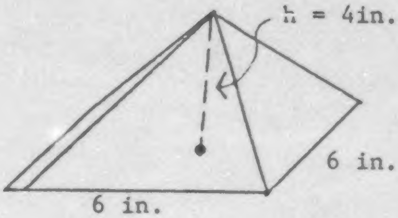

h = 3yds.
2yds.
12 yds.

#2

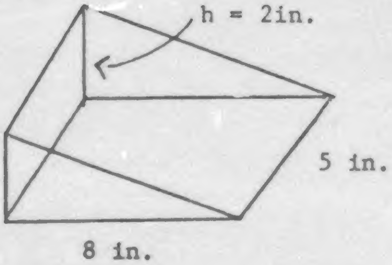


A of base = 18 sq.ft.

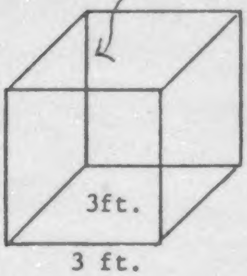
#5


h = 4in.
6 in.
6 in.

#3


h = 2in.
5 in.
8 in.

#6


h = 3ft.
3ft.
3 ft.

IF YOU HAVE A VOLUME DEMONSTRATION SFT WITH PLASTIC SOLIDS WHICH CAN BE FILLED WITH WATER OR SAND, USE IT HERE. USING THE MODELS CONSTRUCTED BY THE STUDENTS IT IS EASY TO SHOW THAT TWO LIKE #2 CAN FIT TOGETHER TO MAKE ONE LIKE #1, SO #2 = 1/2 OF #1. IT IS NOT EASY TO SHOW #3 IN THIS WAY.

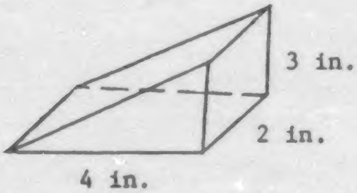
VOLUMNS:

1. 84 CU.FT.
2. 24 CU.FT.
3. 40 CU.FT.
4. 36 CU.YARDS
5. 48 CU.IN.
6. 27 CU.FT.

END CLASS HERE

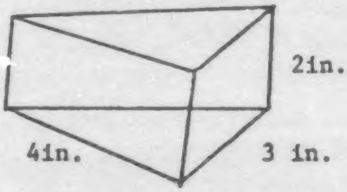
It's A Rip Off

Look at your model wedge this way:



V = 1/2 A X h = 1/2 X 8 X 3
= 12 CU.IN.

Now look at the wedge this way:



Is the formula the same?

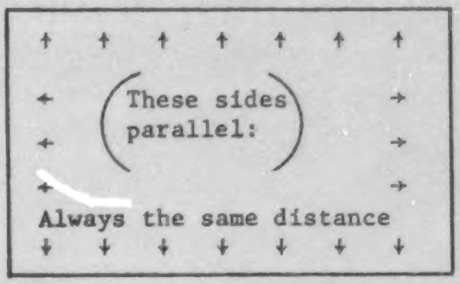
Is the volume the same?

V = A X h = 6 X 2 = 12 CU.IN.

8. Plane Surfaces.

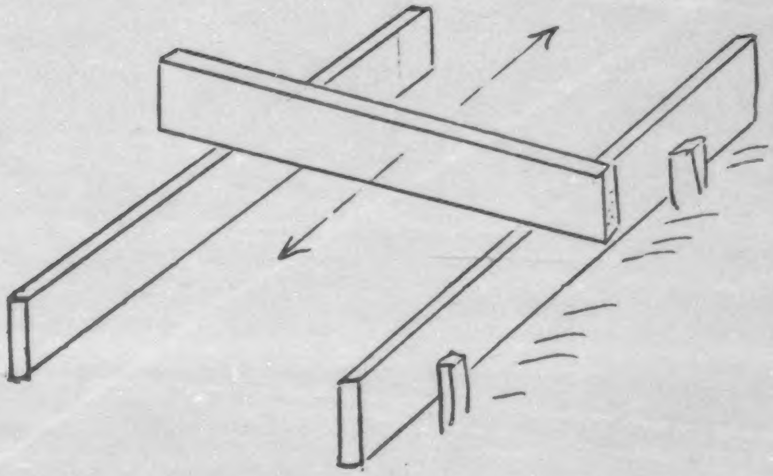
When the cement was delivered and poured into the forms, Sam helped the journeyman cement mason level it. Then the journeyman used a float and trowel to produce a smooth surface.

Making a surface flat and level is very important, as you might guess. A flat level surface is called a plane. When the forms were set, the contractor was careful to see that the sides were parallel, like this:



Two lines, or two sides of the form are parallel if they are always the same distance apart, like straight railroad tracks.

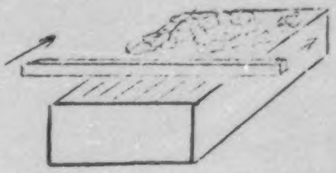
When two sides of the form are parallel a straight board resting on the forms will smooth the cement into a level flat surface.



THE IDEA HERE IS TO SHOW THAT 2 PARALLEL LINES DETERMINE A PLANE AND THAT TWO INTERSECTIN LINES DETERMINE A PLANE. BOTH THESE PRINCIPLES ARE USED TO LEVEL CONCRETE IN A FORM.

A BOX OF SAND CAN BE USED AS A NICE DEMONSTRATION OF THIS.

THE BOX IS LIKE THE FORM AND THE SAND LIKE THE CONCRETE.



LEVEL THE SAND BY MOVING THE STICK. ENCOURAGE THE STUDENTS TO DO THE "MISSION INCREDIBLE" PROJECT TO ILLUSTRATE THIS.

USE OTHER EXAMPLES OF PLANES FOUND AROUND THE ROOM AS FURTHER EXAMPLES OF THE IMPORTANCE OF PLANE SURFACES IN CONSTRUCTION.

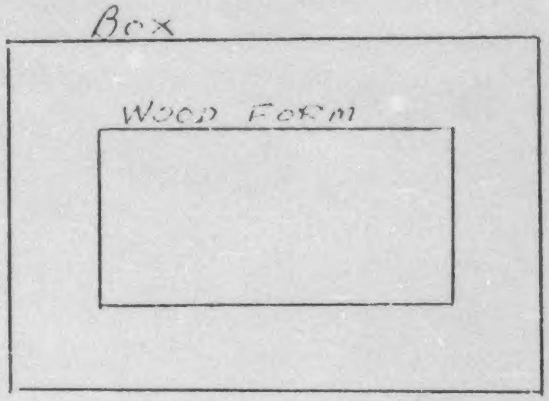
C.O.M.P.
Cement Mason
Follows Lesson 8

MISSION INCREDIBLE

This is your mission, should you choose to accept it: to make a model to show the class how concrete is leveled in forms.

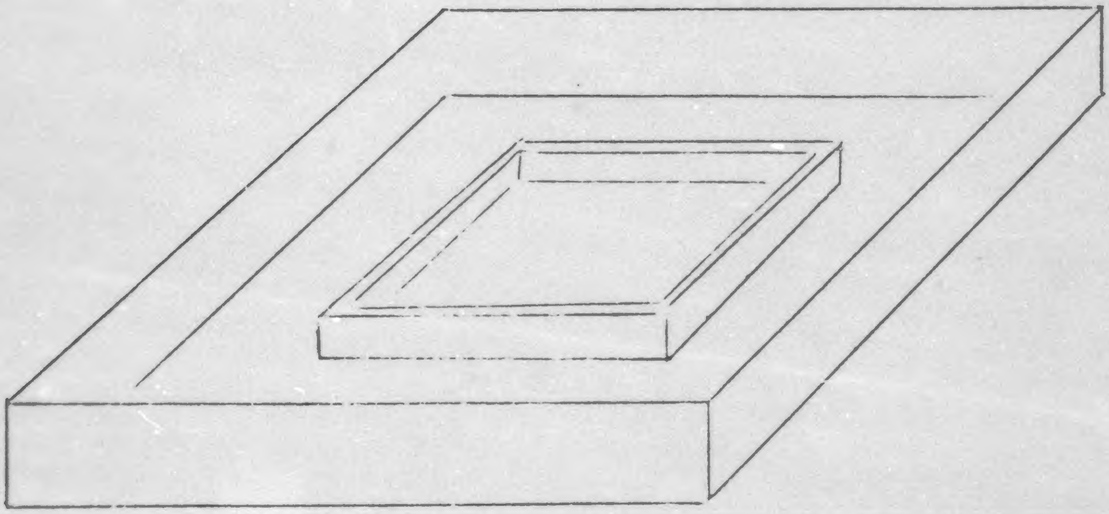
Obtain the following materials: a large shallow box, 10 feet of wood about 1 in. x $\frac{1}{2}$ in., glue, dry sand (a shoe box full is enough). Make it like this:

Glue an 18 in. x 12 in. rectangle of wood to the bottom of the box.



Use remaining wood for a "leveling plank."

Looks Like This



It's A Grump (Round off all decimals to the nearest hundredth.)

1. $35 \times 97 = 3395$
2. $23.4 + 6.8 + 19.3 = 49.50$
3. $437.8 \div 12.4 = 35.31$
4. $2\frac{1}{2} + 5\frac{2}{3} = 8\frac{1}{6}$
5. $9.68 \times 5.41 = 52.37$
6. $2\frac{3}{4} - 1\frac{1}{5} = 1\frac{11}{20}$
7. $14\frac{1}{2} \times 1\frac{3}{4} = 25\frac{3}{8}$
8. $7 \times 9.3 \times 42 = 2734.20$
9. $5\frac{2}{5} - 1\frac{1}{2} = 3\frac{9}{10}$
10. $43.7 \div 129.1 = 0.34$

END CLASS HERE

9. Cost of Cement Finishing

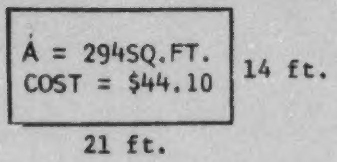
When the concrete has been leveled, the journeyman uses the float and trowel to produce a smooth surface. When the contractor is estimating the cost of the job he figures from 12 to 15 cents per square foot for cement finishing. Go back to the blue print and figure the cost of finishing the concrete driveway and garage floor. Use ____________ per square foot as the cost.

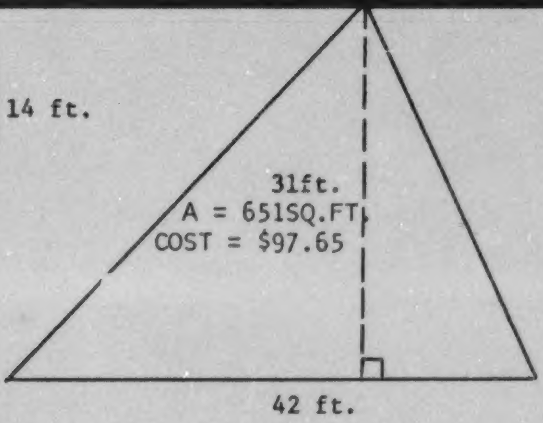
FOR THIS LESSON USE 15¢ PER SQUARE FOOT OR THE LOCAL FIGURE YOUR STUDENTS GOT IN THE "MISSION INCREDIBLE" ASSIGNMENT.

TELL THE STUDENTS THE FIGURE TO USE. ALLOW TIME TO COMPLETE THIS PROBLEM. THE ANSWERS GIVEN USE 15¢ PER SQUARE FOOT.

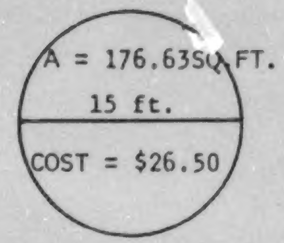
	Area	Cost
Garage Floor	400 SQ. FT.	$60.00
Quarter Circle ◟	50.24 SQ. FT.	7.54
Driveway	912 SQ. FT.	136.80

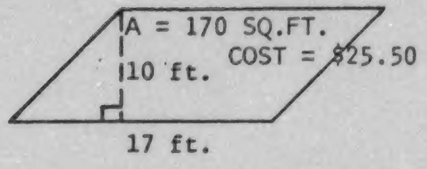
Calculate the area of each of these shapes and then the cost of finishing them if they were poured in concrete.

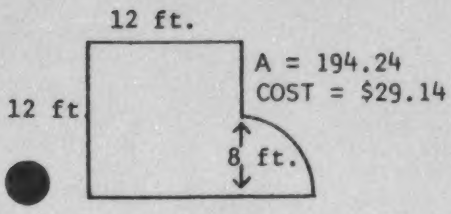

A = 294SQ.FT.
COST = $44.10
14 ft.
21 ft.


31ft.
A = 651SQ.FT.
COST = $97.65
42 ft.

ANSWERS GIVEN ARE FIGURED AT 15 CENTS PER SQUARE FOOT.


A = 176.63SQ.FT.
15 ft.
COST = $26.50


A = 170 SQ.FT.
COST = $25.50
10 ft.
17 ft.


12 ft.
12 ft
A = 194.24
COST = $29.14
8 ft.

END CLASS HERE

10. Foundation For A House

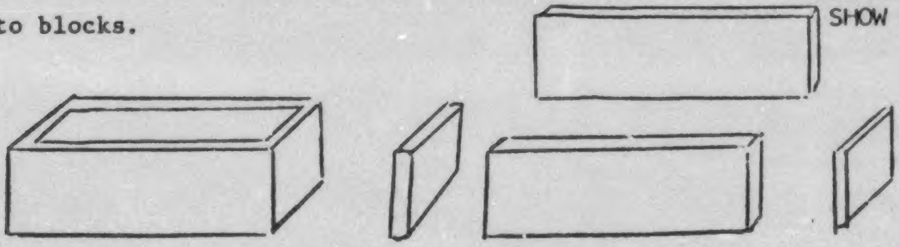
Sam's next job was to pour a foundation, a "footing," for a small house. The shape of the house was marked with stakes on the ground and the excavation was done by a man using a power shovel. Why is so much more work done by power equipment now? Some people say that using power equipment cuts down on jobs. What do you think?

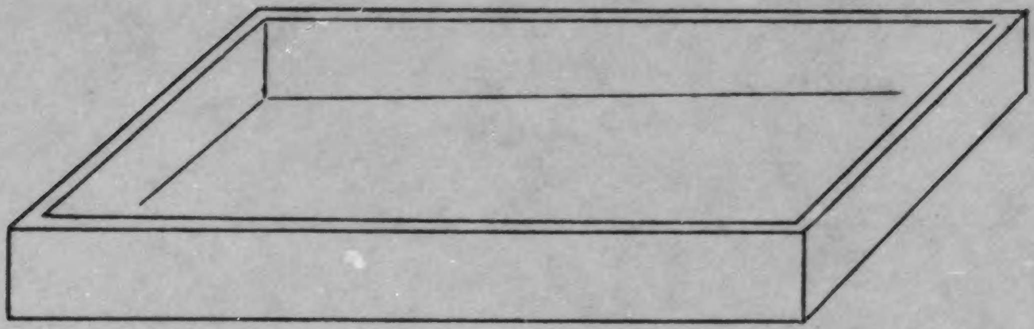
The foundation of the house was to be constructed following the blue print (next page). When the forms are constructed the volume must be determined approximately in cubic yards. To figure the volume, imagine cutting the foundation into blocks.

MATERIALS: 2 BOXES (200) CUBIC INCH BLOCKS FOR CONSTRUCTING MODELS FOR DEMONSTRATION.

POWER EQUIPMENT IS USED BECAUSE IT IS CHEAPER AND FASTER THAN HAND LABOR. SOME JOBS ARE LOST BUT OTHERS ARE CREATED. NEW JOBS ARE GENERALLY MORE TECHNICAL THAN THOSE LOST.

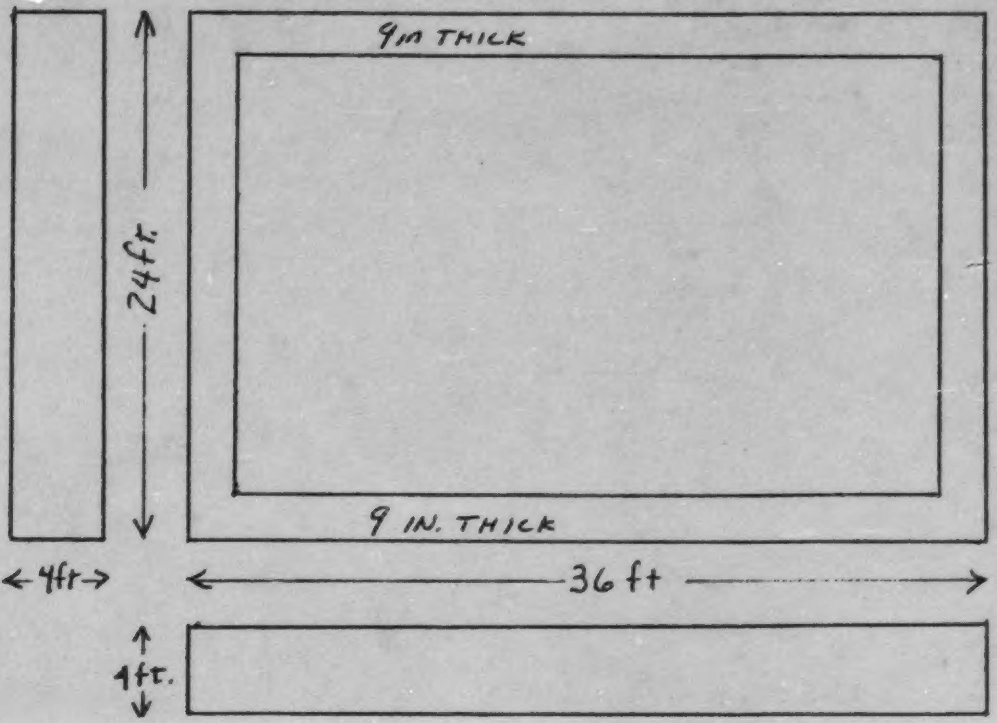
CONSTRUCT A "FOUNDATION LIKE" SHAPE USING THE CUBICAL INCH BLOCKS. TAKE IT APART TO SHOW HOW THIS WOULD BE DONE.





SKETCH

BLUEPRINT


9 in THICK
24 ft.
9 IN. THICK
← 4 ft →
← 36 ft →
4 ft.

SCALE: 1 in = 8 FEET
DO NOT SCALE THICKNESS.

What are the dimensions of each block?

Short side: l = ________ w = ________ h = ________

Long side: l = ________ w = ________ h = ________

Now calculate the volume in cubic yards of concrete needed to fill the cement form. Would you order exactly that amount? How much concrete would you order? How much would that much concrete cost?

$V = l \times w \times h$

SHORT SIDE = $8\text{ YDS.} \times \frac{1}{4}\text{ YD.} \times \frac{4}{3}\text{ YD.} = 2\frac{2}{3}\text{ CU. YDS.}$

LONG SIDE = $11\frac{1}{2}\text{ YDS.} \times \frac{1}{4}\text{ YD.} \times \frac{4}{3}\text{ YD.} = 3\frac{5}{6}\text{ CU. YDS.}$

NOW, 2 OF EACH OF THOSE

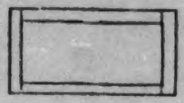
$2 \times 2\frac{2}{3} = 5\frac{1}{3}$

$2 \times 3\frac{5}{6} = 7\frac{4}{6}$

13 CUBIC YARDS. BETTER ORDER $13\frac{1}{2}$ YDS.

$\$22.35 \times 13.5 = \$301.73$

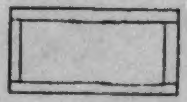
ANSWERS MAY VARY HERE:



CUT THIS WAY

S.S. l = 24, w = 9 IN., h = 4FT.

l.S. l = $34\frac{1}{2}$FT., w = 9 IN., h = 4 FT.



CUT THIS WAY

S.S. l = $22\frac{1}{2}$FT., w = 9 IN., h = 4 FT.

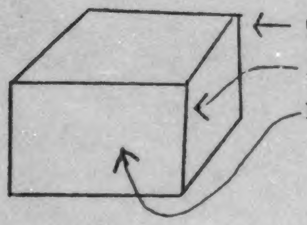
l.S. l = 36FT., w = 9 IN., h = 4 FT.

OF COURSE THE VOLUME WILL BE THE SAME IN EITHER CASE.

GIVE THE STUDENTS TIME TO FINISH THE CALCULATION OF THE VOLUME, AND THE COST.

Here are three more foundations. Find the volume of each one in cubic yards and estimate the quantity of concrete you would order for each one.

It's A Rip Off



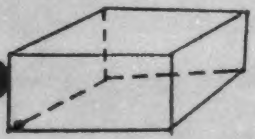
← Corner point: Vertex, V.

2 sides meet: Edge, E.

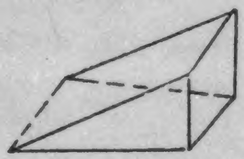
Flat surface: Face, F.

What do you know about that?

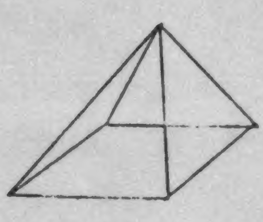
Try some other solids!



F + V − E = ________



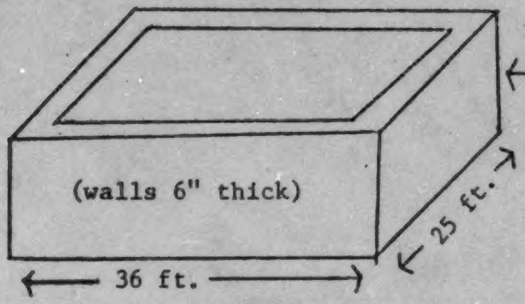
F + V − E = ________



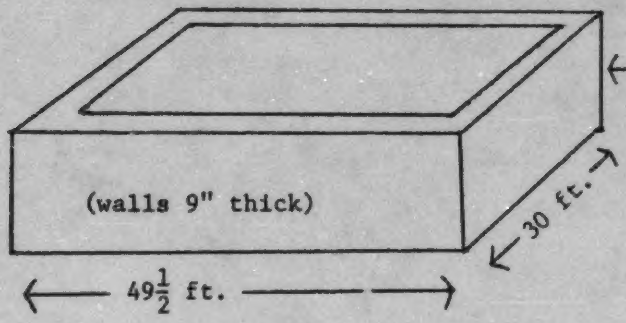
F + V − E = ________

G.R.U.M.P.

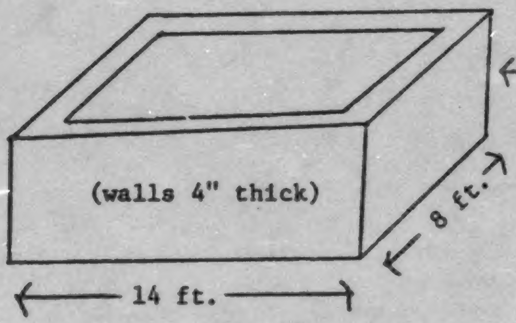
$$\begin{array}{rcl} 3\frac{3}{5} & = & 2\frac{16}{10} \\ -\,1\frac{7}{10} & = & 1\frac{7}{10} \\ \hline & & 1\frac{9}{10} \end{array} \qquad \begin{array}{rcl} 4\frac{2}{3} & = & 4\frac{8}{12} \\ +\,1\frac{3}{4} & = & 1\frac{9}{12} \\ \hline & & 6\frac{5}{12} \end{array} \qquad 2\frac{3}{5} \times 1\frac{1}{2} = 3\frac{9}{10}$$


6 ft.
(walls 6" thick)
25 ft.
36 ft.

$13\frac{1}{3}$ CU.YDS.
(ORDER $13\frac{1}{2}$ OR
14 CU.YDS.)


3 ft.
(walls 9" thick)
30 ft.
$49\frac{1}{2}$ ft.

13 CU.YDS.
(ORDER $13\frac{1}{2}$
CU.YDS.)


2 ft.
(walls 4" thick)
8 ft.
14 ft.

$28\frac{4}{9}$CU.FT. =
A BIT MORE THAN
1 CU.YD., ORDER
$1\frac{1}{3}$ CU.YD.

STRONGLY ENCOURAGE 5 OR 6 STUDENTS TO FORM "TEAMS" TO DO THE "MISSION INCREDIBLE" ON THE NEXT PAGE. LESSON 11 IS BASED ON SEVERAL STUDENTS DOING IT.

END CLASS HERE

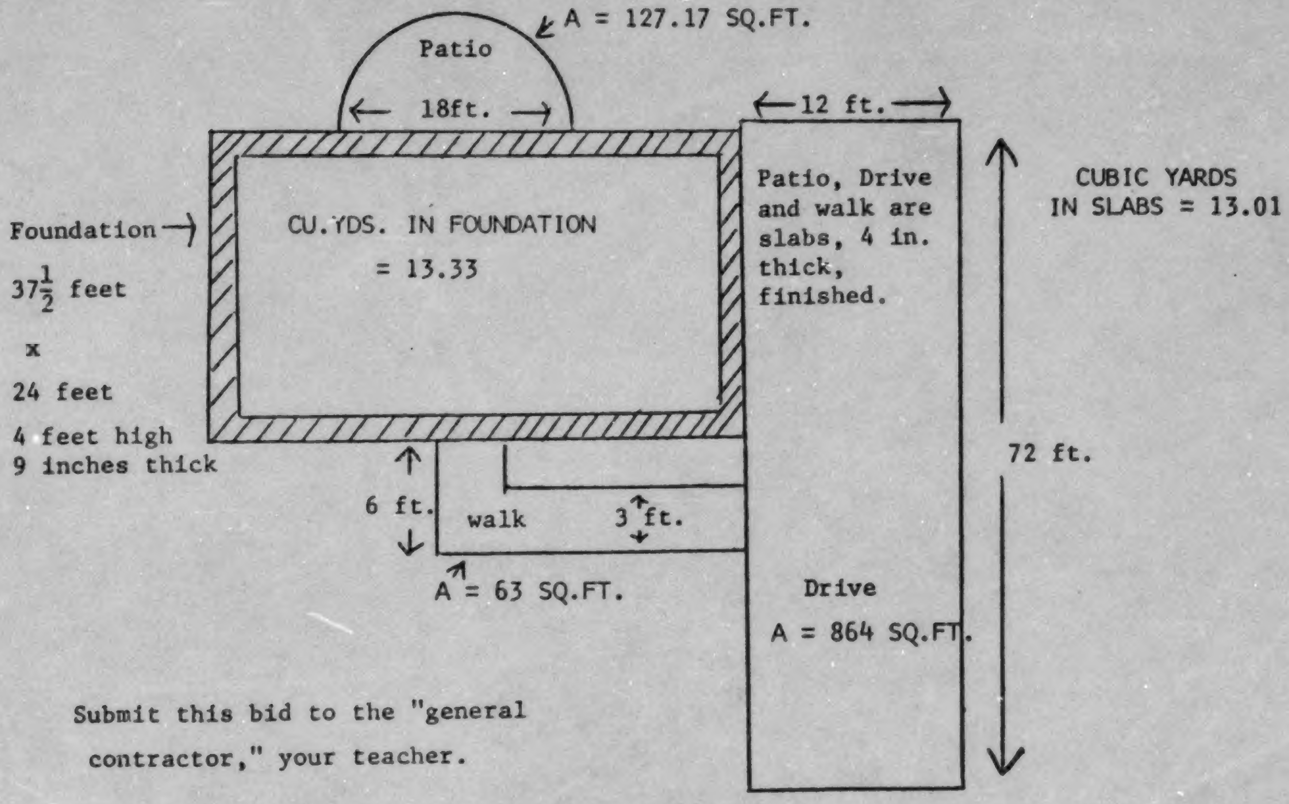
MISSION INCREDIBLE

This is your mission, if you choose to accept it: You are a cement contractor and you are bidding on the cement work for a new subdivision. There will be 10 houses but the cement work for each will be the same. Prepare your estimate as follows. This job will take about 20 days, one working month.

1. Concrete 270 yards @ 22.35 per yard: $6,034.50
2. Labor (unskilled) $100 per house: $1,000.00
3. Labor (cement finisher) 15¢ per foot: $1,581.30
4. Profit 30 % $2,584.74

Total Bid $11,200.54

ACTUALLY 263.4
BUT CAN'T BE
THAT EXACT.


A = 127.17 SQ.FT.
Patio
18ft.
12 ft.
Foundation
37½ feet
x
24 feet
4 feet high
9 inches thick
CU. YDS. IN FOUNDATION
= 13.33
Patio, Drive and walk are slabs, 4 in. thick, finished.
CUBIC YARDS
IN SLABS = 13.01
72 ft.
6 ft.
walk
3 ft.
A = 63 SQ.FT.
Drive
A = 864 SQ.FT.

Submit this bid to the "general contractor," your teacher.

11. Opening The Sealed Bids

Several bids have been received from cement contractors for the work on the new subdivision. At this time the general contractor will now open the bids and award the contract.

What is the purpose of having "bids" for a job? x
Why are these bids kept secret? x

BIDS MEAN THAT CONTRACTORS ARE COMPETING TO BE "LOW BIDDER" AND GET THE JOB. IT WILL MEAN LESS COST FOR THE GENERAL CONTRACTOR AND MORE PROFIT. THE BIDS ARE SECRET SO ONE CONTRACTOR CANNOT UNDER CUT ANOTHER BY A SMALL AMOUNT.

When each bid has been opened and the bids listed on the board, work out the "cost" for each item.

Cost for concrete ______________________
Cost for unskilled labor ______________________
Cost for finishing ______________________
Total Cost ______________________

NOW OPEN THE BIDS AND POST THEM. ON THE BOARD WRITE THE NAME OF EACH BIDDER AND HIS "BID."

FOR ANSWERS TO THESE QUESTIONS LOOK AT TEACHER'S COPY OF THE MISSION INCREDIBLE EXERCISE.

WORK OUT ON THE BOARD THE COST OF EACH ITEM, LETTING DIFFERENT STUDENTS DO VARIOUS PARTS OF THE CALCULATION.

How do the bids compare to the total cost? Are any bids actually below cost? How did that happen? x x

What percent profit is reasonable for this job? Remember that the contractor will work one month on this job and take a big risk! What should he make in "profit" for this?

Consider cost, the contractors salary, and profit, what is a "best" bid?

A CONTRACTOR RISKS ACCIDENT, BAD WEATHER, POOR WORK WHICH MUST BE DONE AGAIN, RISING PRICES AND OTHER PROBLEMS. IF HE ESTIMATES "TOO CLOSE" HE WILL LOSE HIS TIME AND MONEY.

LET THE CLASS DISCUSS AND DECIDE.

GRUMP

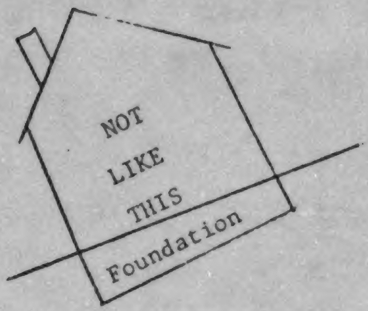
$$\begin{array}{r} 43.2 \\ \times\ 1.4 \\ \hline 60.48 \end{array} \qquad \begin{array}{r} 19.73 \\ -\ 4.94 \\ \hline 14.79 \end{array} \qquad \begin{array}{r} 80.221 \\ 3.7\overline{)\,296.82} \end{array}$$

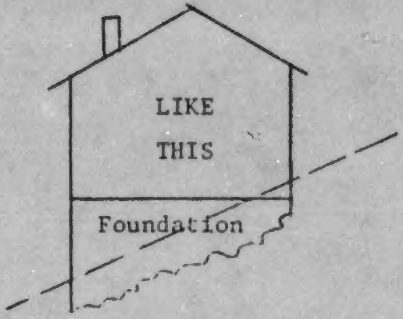
END CLASS HERE

---

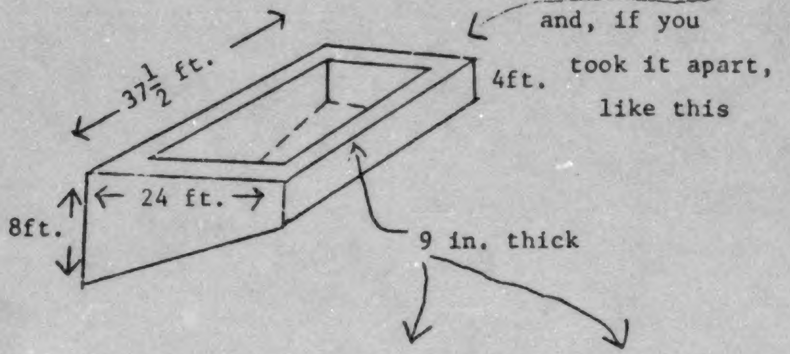
12. Volume of Foundations Which Are Not Level.

Sam found that pouring a foundation for a house on a hill was different! The volume of concrete needed was not as easy to figure. Of course the house has to be level ...

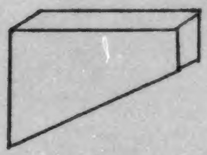

NOT
LIKE
THIS
Foundation


LIKE
THIS
Foundation

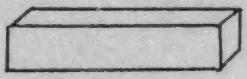
The foundation for this house might look like this


$37\frac{1}{2}$ ft.
4ft.
8ft.
24 ft.
9 in. thick

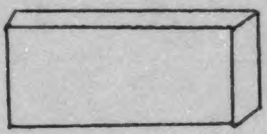
and, if you took it apart, like this



(2 like this)

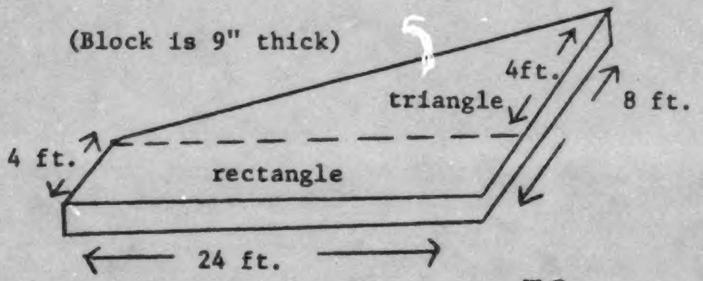


(1 like this)



(1 like this)

Sam found that the volume of the end blocks (⏢) was hard to calculate. Then he found that he could think of it like this:


(Block is 9" thick)
4ft.
triangle
8 ft.
4 ft.
rectangle
24 ft.

Then the volume formula $V = Ah$ (area x height) could be used. The area could be divided into a rectangle and a triangle. Calculate the area of the rectangle:

THE STUDENTS WILL PROBABLY NEED HELP AND FURTHER EXPLANATION ON THIS PROCESS. WORK THROUGH IT WITH THEM.

$A = l \times w = 8\text{YDS.} \times \frac{4}{3}\text{YD.} = 10\frac{2}{3}\text{ SQ.YDS.}$

Now, the area of the triangle:

$A = \frac{1}{2}bh = \frac{1}{2} \times 8\text{YDS.} \times \frac{4}{3}\text{YD.} = 5\frac{1}{3}\text{SQ.YD.}$

Total area: 16 SQ. YDS.

height : $\frac{1}{4}$ YD. (9IN.)

Volume = A x h

$= 16\text{ SQ.YD.} \times \frac{1}{4}$

$= 4\text{ CU.YDS.}$

Volume in cubic yards = 4

Now complete the calculations for the other sides:

Short Side

$V = l \times w \times h = 12\text{YDS.} \times \frac{4}{3}\text{YD.} \times \frac{1}{4}\text{YD.} = 4\text{ CU.YDS.}$

Tall Side

$V = l \times w \times h = 12\text{YD.} \times \frac{8}{3}\text{YD.} \times \frac{1}{4} = 8\text{CU.YDS.}$

Two Slanted sides

(WE FOUND 4 EACH, SO 8 CU.YDS.)

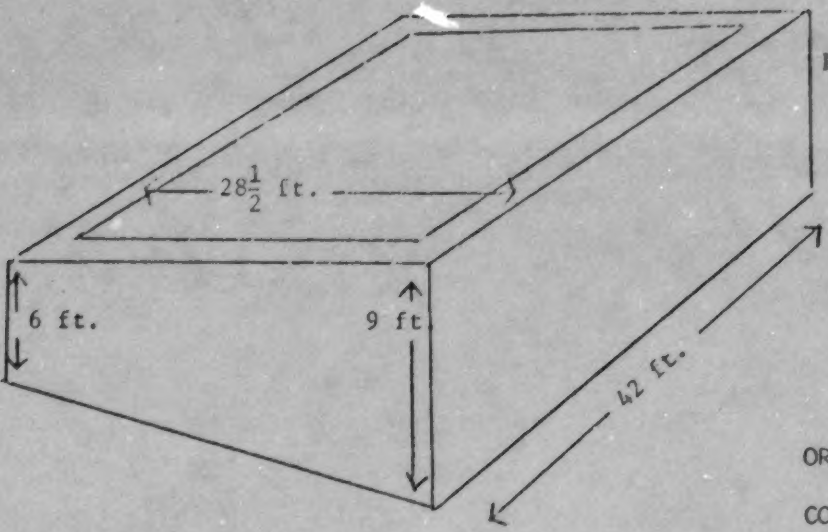
Total: 20CU.YDS.

GRUMP

$$\begin{array}{r} 421 \\ 3596 \\ 285 \\ 37 \\ \underline{+\ 9571} \\ 13{,}910 \end{array} \qquad \begin{array}{r} 8{,}356 \\ \underline{-\ 2{,}178} \\ 6{,}178 \end{array} \qquad \begin{array}{r} 29 \\ \underline{\times\ 43} \\ 1247 \end{array}$$

$$7 \overline{)\ 27{,}968}^{\,64}$$

Here is one more hillside foundation:



All blocks are 9" thick. Find

Volume: ____________________

Volume to be ordered: __________

Cost: ____________________

13. Small Job Work.

Sam does small jobs when he has spare time or when business is slow. For most of these jobs he buys bags of concrete mix and mixes it himself. What did your "mission incredible" team find out about the cost of bags of concrete mix? ____________

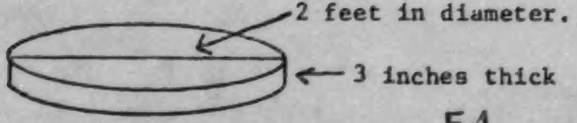
How does the cost of concrete in bags compare to the cost of concrete delivered by truck?

Cost in bags $91.26 CU.YD.

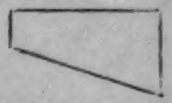
Cost from truck $22.35 CU.YD.

(Is there any other reason for prefering the concrete be delivered by truck?)

Sam charged $25.00 to make a base for a bird bath. The base is shown here:



2 LIKE THIS, EACH 5.625



V = 11.25CU.YD.

I LIKE THIS

V = 10.5CU.YD.

I LIKE THIS

V = 7.0CU.YD.

28.75CU.YD.

ORDER 30 CU.YDS.

COST $670.50

END CLASS HERE

USE LOCAL PRICES OR THE FOLLOWING:
68LB. FOR $1.69 MAKES $\frac{1}{2}$CU.FT.
OR 90LB. FOR $2.09 MAKES $\frac{2}{3}$CU.FT.

THIS IS A FAIRLY COMPLEX PROBLEM. LET THE STUDENTS WORK ON IT AND DISCUSS IT. YOU LEAD THE DISCUSSION.

ANSWER GIVEN IS BASED ON $1.6[illegible] PER $\frac{1}{2}$CU.FT.

For this job he provided the concrete, which he mixed himself from a bag. How much concrete did he need and what was his profit for that job?

He charged $35.00 for patching some cement stairs. Patching work does not use much concrete, but it takes a long time. He used 1/2 bag of concrete mix and worked 4 hours on the job. How much did he make per hour?

GRUMP

$3\frac{4}{5} \times 1\frac{2}{3} = \underline{\quad 6\frac{1}{3} \qquad\qquad}$

$5\frac{1}{2} \quad 2\frac{1}{2} = \underline{\quad 2\frac{1}{5} \qquad\qquad}$

$$\begin{array}{r} 3\frac{3}{4} \\ +\ 2\frac{1}{5} \\ \hline 5\frac{19}{20} \end{array} \qquad\qquad \begin{array}{r} 5\frac{1}{3} \\ -\ 2\frac{3}{5} \\ \hline 2\frac{11}{15} \end{array}$$

14. Summary

How did Sam get started in his trade?

He had to go to Atlanta and be an apprentice for 3 years. Why?

What are the advantages of spending a long apprenticeship learning a trade? What are the disadvantages?

What will Sam earn as an apprentice? Could you earn more in a "regular job?" What does Sam expect to earn eventually?

When Sam finished his apprenticeship he could stay in a large city or he could move back to his home town. Which would you do?

Would you do what Sam did?

3.14 SQ.FT. AREA

$3.14 \times \frac{1}{4}$ FT. THICK

= .79 CU.FT.

HE NEEDS 2 BAGS @ $1.69 = $3.38

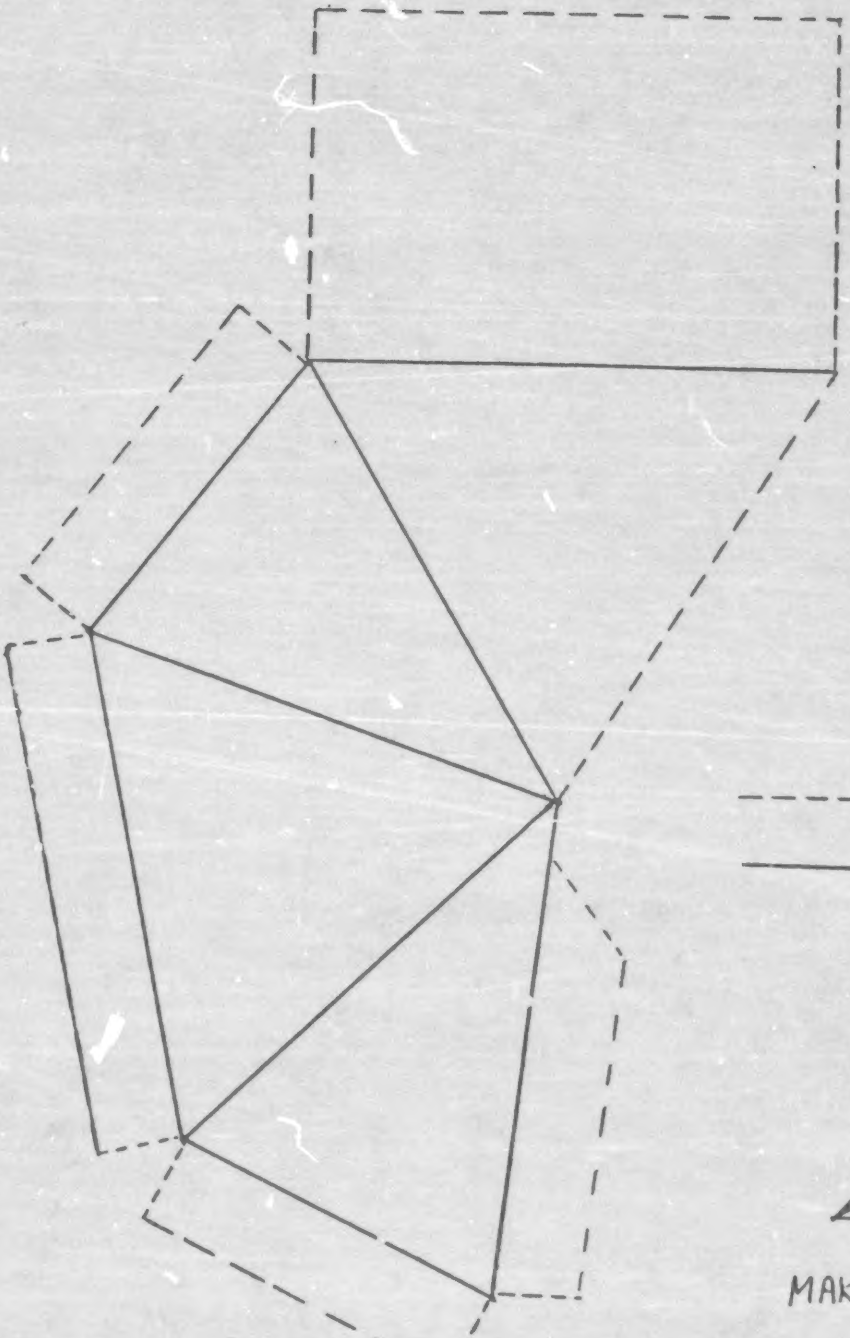
PROFIT $21.62

HALF A BAG COSTS $.85

$$\begin{array}{r} 35.00 \\ -\ \ .85 \\ \hline 34.15 \end{array}$$

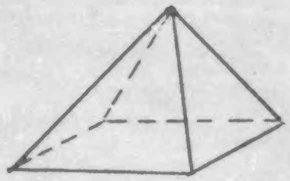
$$\begin{array}{r} \$\ \ 8.54 \\ 4\ \overline{)\ 34.15} \end{array} \text{ PER HOUR.}$$

THESE QUESTIONS ARE DESIGNED TO REVIEW THE "APPRENTICESHIP" ROUTE OF ENTRY INTO A TRADE. TO DO THIS YOU MUST GO WHERE THE UNION HAS A GOOD APPRENTICE PROGRAM. THIS USUALLY MEANS LEAVING HOME. IS IT WORTH IT? ENCOURAGE DISCUSSION OF THE ADVANTAGES AND DISADVANTAGES OF BEING AN "APPRENTICE" AND OF LEARNING A TRADE.

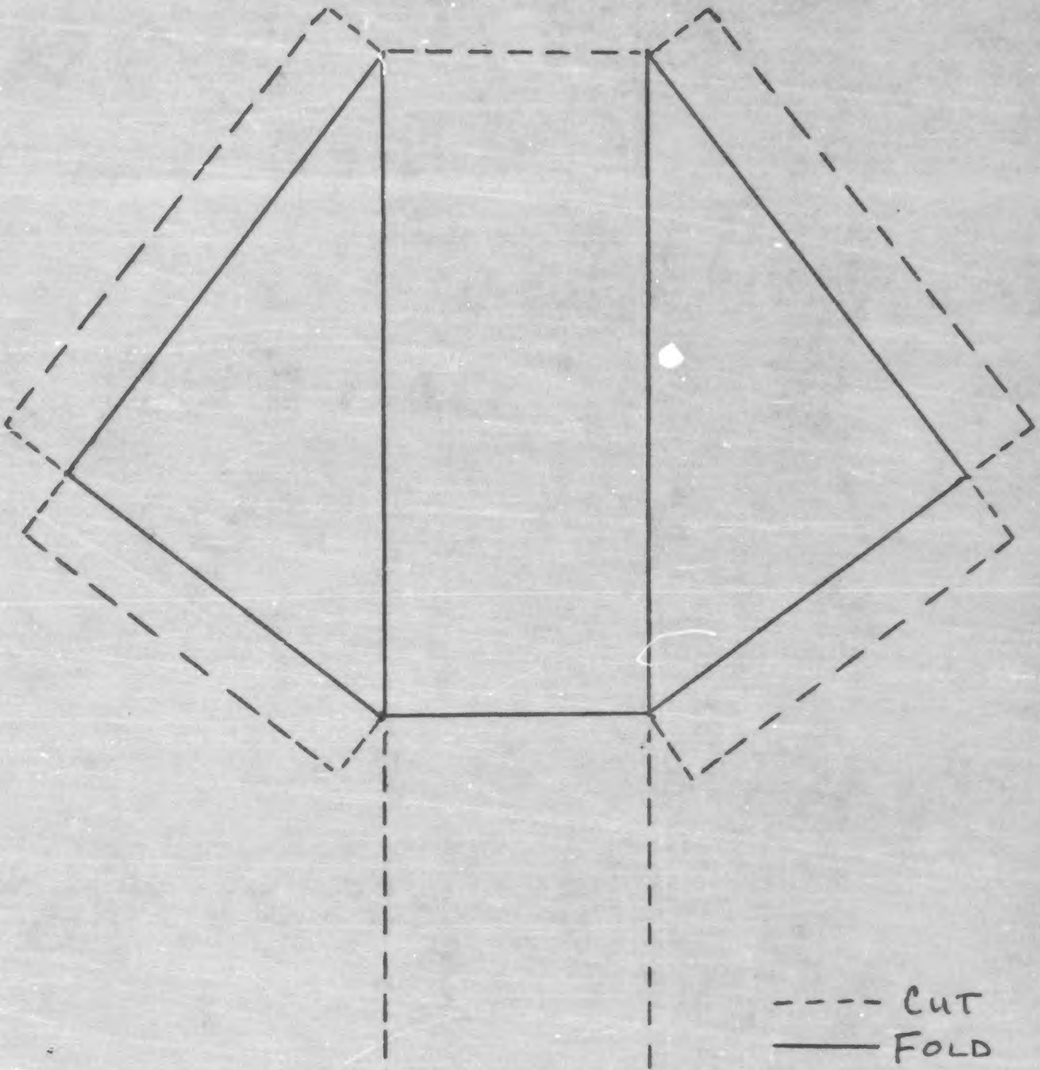


- - - - CUT

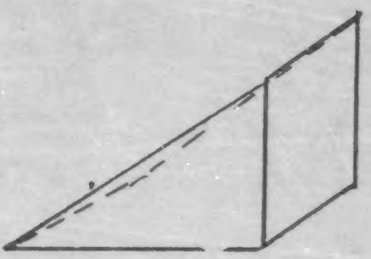
—— FOLD



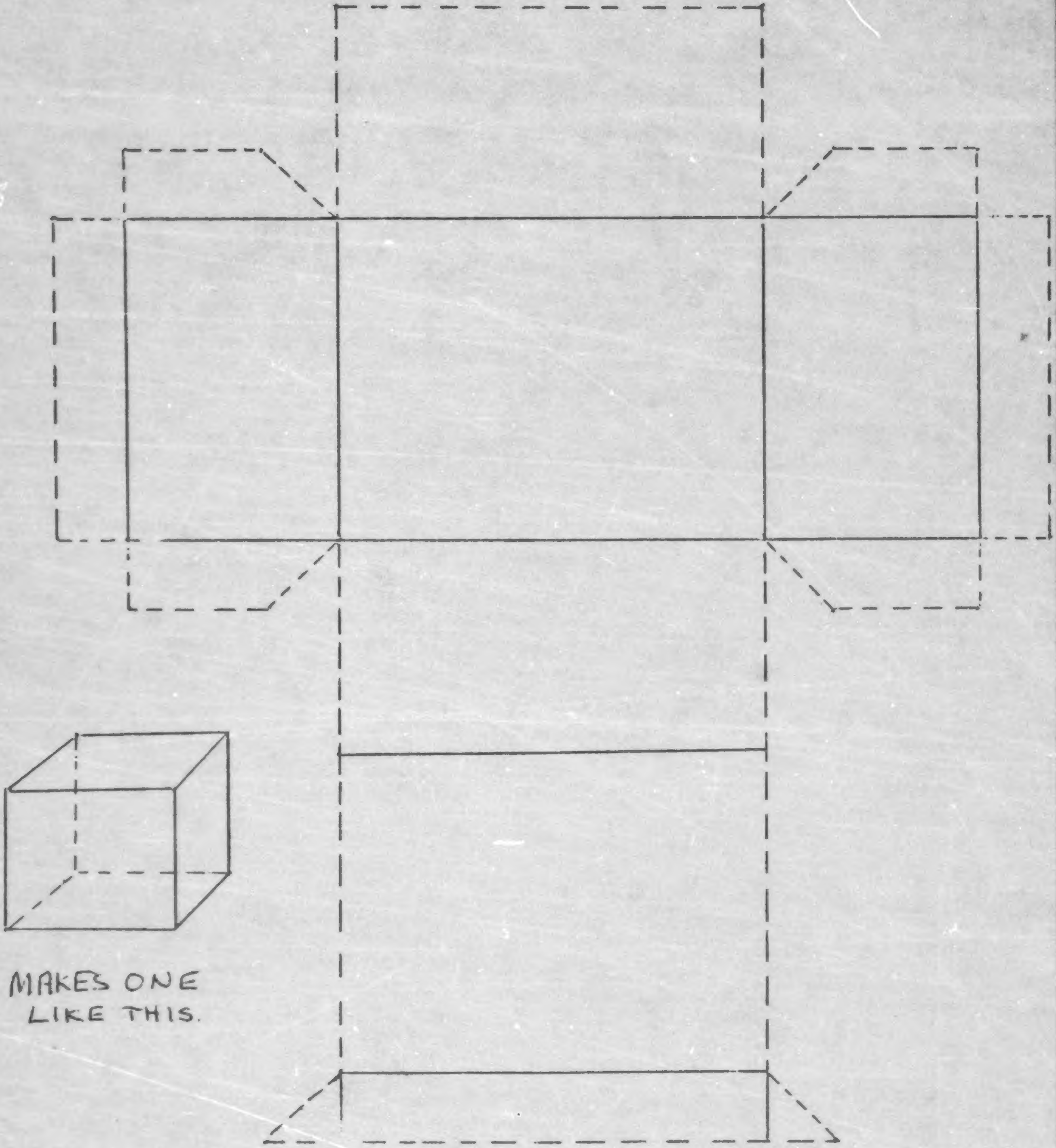
MAKES ONE LIKE THIS



╌╌╌╌ CUT
──── FOLD
TAPE OR GLUE

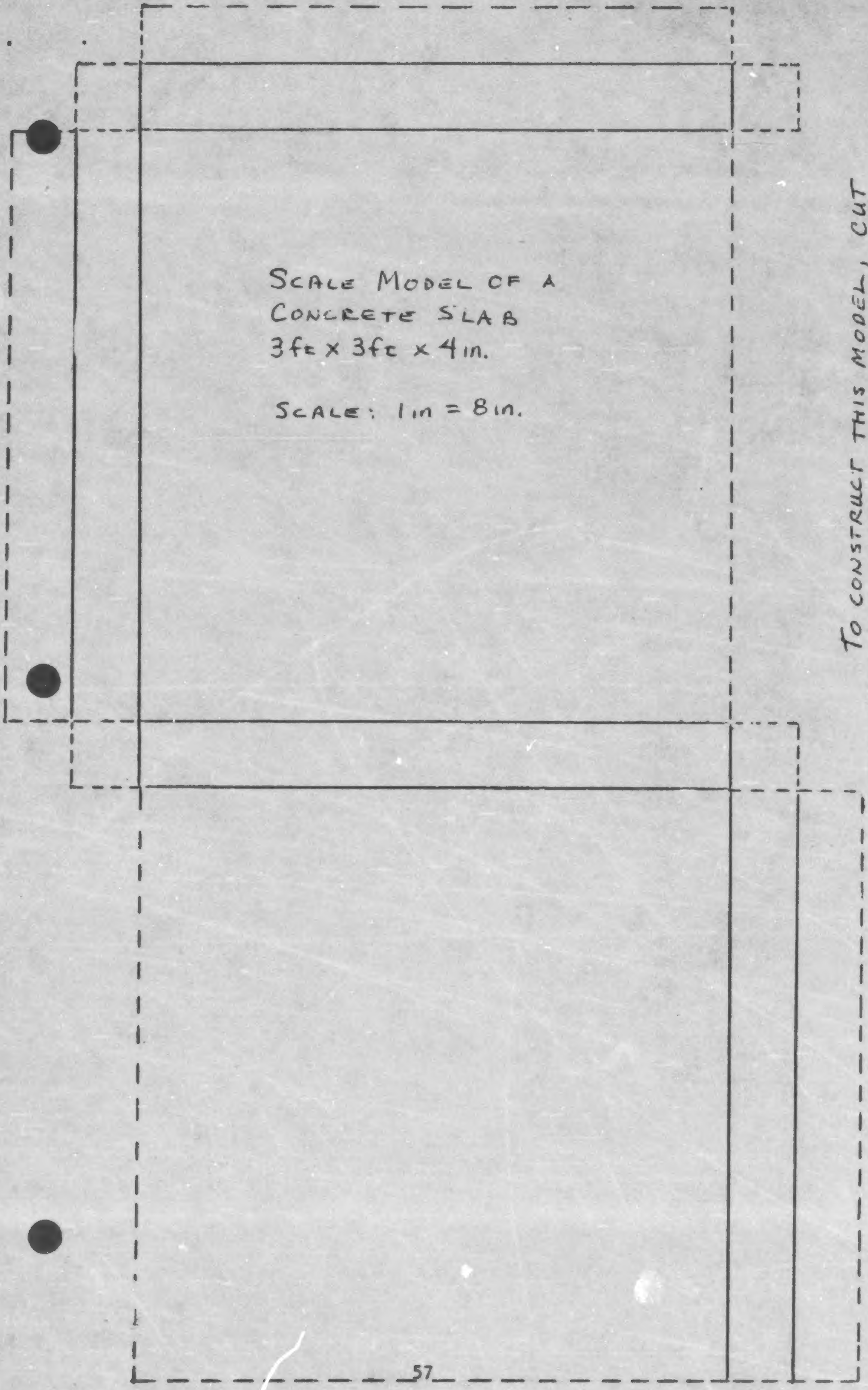


MAKES ONE LIKE THIS



MAKES ONE
LIKE THIS.

TO CONSTRUCT T MODEL, CUT ALONG
DOTTED LINES D FOLD ALONG SOLID
LINES. GLUE TAPE TO FORM A BOX.



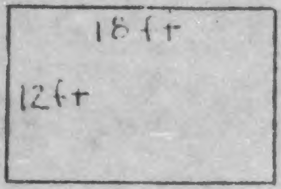
SCALE MODEL OF A
CONCRETE SLAB
3ft x 3ft x 4 in.

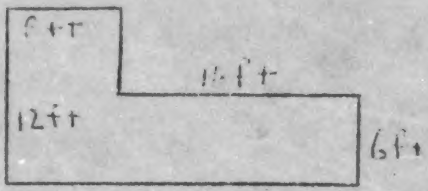
SCALE: 1 in = 8 in.

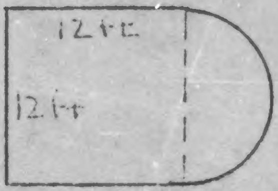
TO CONSTRUCT THIS MODEL, CUT
ALONG DOTTED LINES AND FOLD
ALONG SOLID LINES. GLUE OR
TAPE TO FORM A BOX.

Hour Examination #1
Lessons 1-5

1. Find the perimeter of each of these:




8 ft
18 ft
12 ft
6 ft



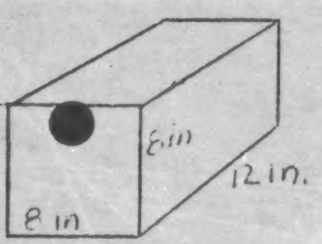
P = 60 Ft

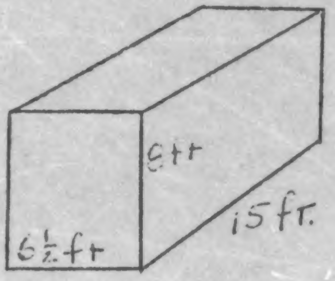
P = 72 Ft

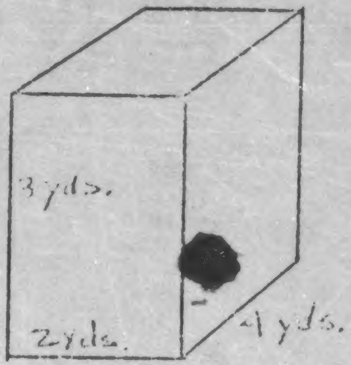
P = 54.8 Ft

(Be sure you state the unit in each answer)

2. Find the Volume of each of these:


8 in
12 in.
8 in


8 ft
15 ft.
$6\frac{1}{2}$ ft


3 yds.
2 yds.
4 yds.

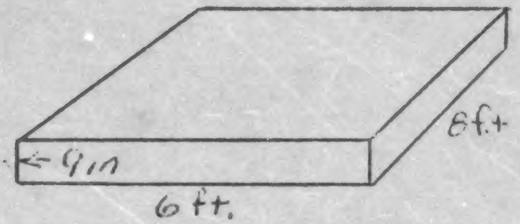
V = 768 Cu in

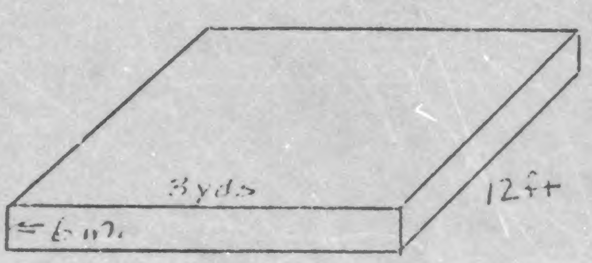
V = 780 cu ft

V = 24 cu yds

(Be sure you state the unit in each answer)

3. Find the Volume of each of these:



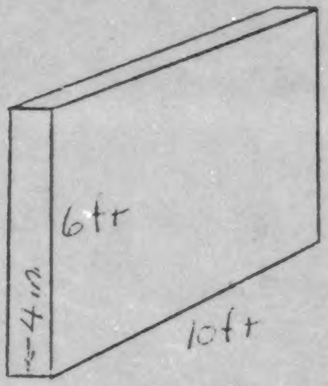

3 yds
12 ft
6 in.

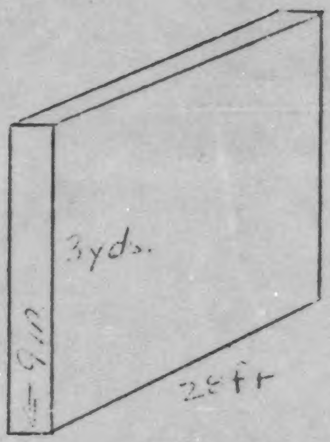
V = 36 cu ft = 62,208 cu in.

V = 54 cu ft = 2 cu yds
= 92,312 cu.in

(Be sure you state the unit in each answer)

4. Find the volume of each of these:





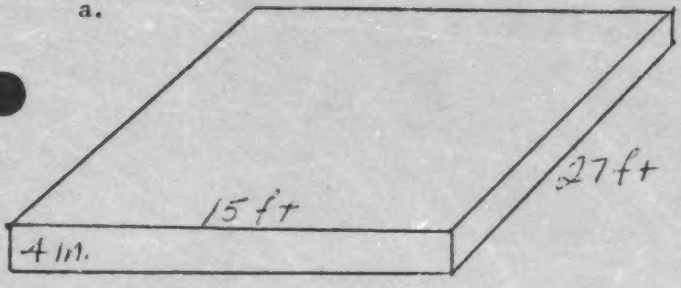
V= 20 cu ft = 34,560 cu. in

V= 189 cu ft = 7 cu. yds

(Be sure you state the unit in each answer.

5. Find the cost of concrete for each of these forms. Use $22.35/cubic yard as the cost.

a.



b. A slab of concrete for a driveway. 15 ft. wide, 47 feet long, 6 in. thick.

a.

Volume 5 cu. yd

Order Vol. 5½ cu yd

Cost $122.93

b.

Volume 13.05 cu. yd.

Order Vol. 13½ cu yd.

Cost $301.73

6.

$4,352.35
651.96
2,153.47
92.50
+ 851.30
$ 8101.58

$3,402.75
− 187.47
$3215.28

$$29\overline{)9,438.21}$$
325.45

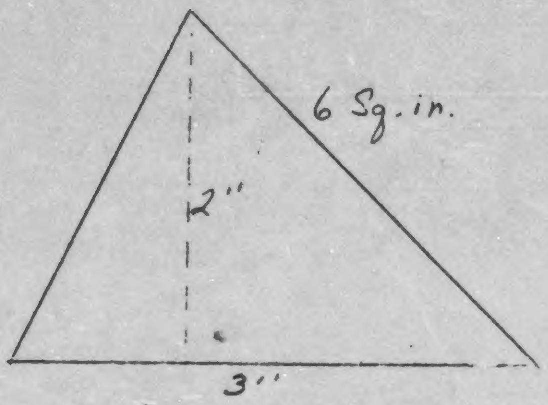
$432.25
x 34
$ 14,696.50

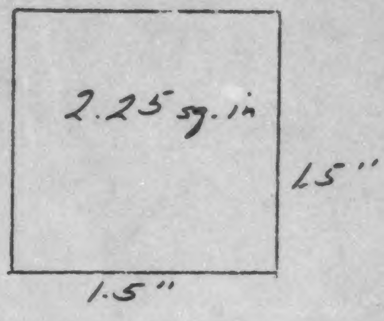
Hour Examination #2
Lessons 6-9
(You will need a ruler for this exam.)

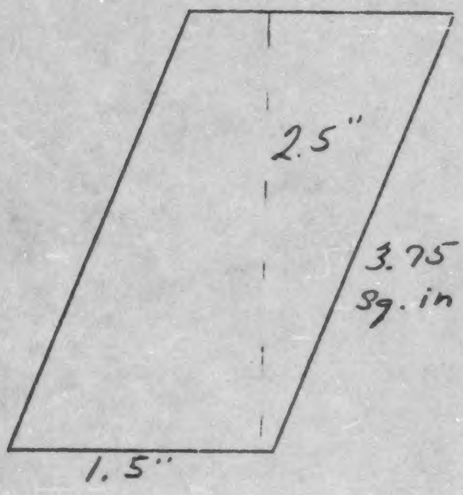
1. Give the appropriate formula:

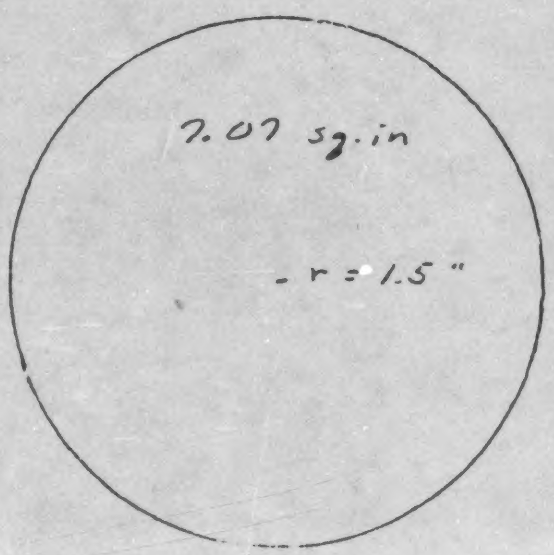
   a. Area of a square A = Side x Side = s^2
   b. Area of a rectangle A = base x ht = bh
   c. Area of a triangle A = ½ x base = $\frac{1}{2}$ bh
   d. Area of a parallelogram A = base x ht = bh
   e. Area of a circle A = π x radius x radius = πr^2

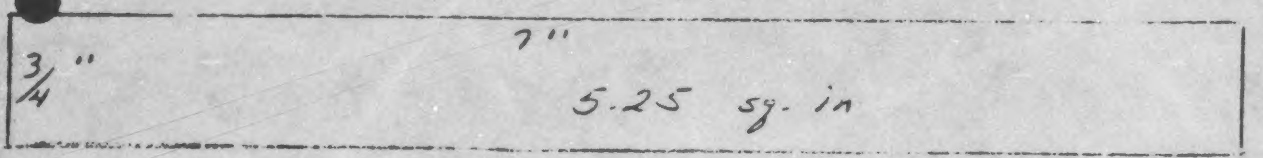
2. Measure each of these figures and find the area in square inches.



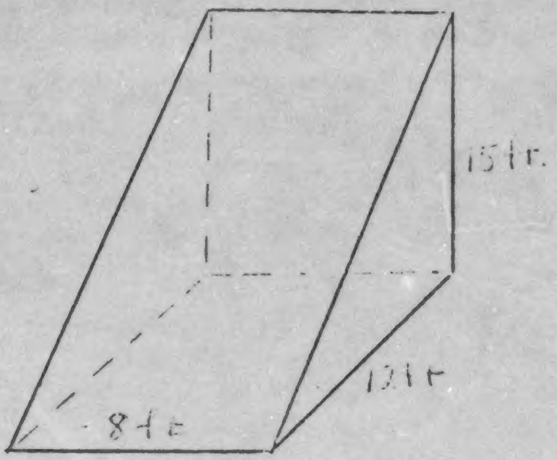

2.25 sq. in
1.5''
1.5''


2.5''
3.75 Sq. in
1.5''

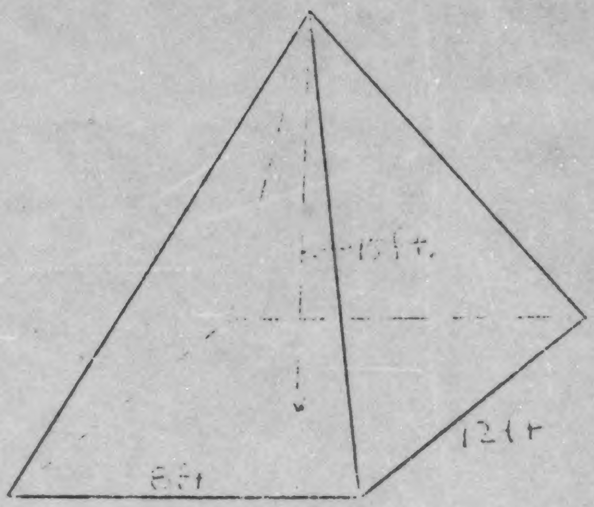

7.07 sq. in
r = 1.5''


7''
3/4''
5.25 sq. in

3. Find the Volume of each of these solids.



$V =$ 720 cu. ft



$V =$ 480 cu. ft

4. If a cement finisher changes 14¢ "per foot", what does he mean by "per foot?"

Per square foot of surface

5. What would the cost be at 14¢ "per foot" for finishing each of these cement slabs?

a. A driveway 15 feet wide by 112 feet long.

$A = L \times W = 15 \times 112 = 1680$ sq ft.
Cost $.14 \times 1680 =$ \$235.20

b. A semi-circular patio with a radius of 27 feet.

$A = \frac{1}{2}\pi r^2 = 1145.11$ sq. ft.
Cost $= .14 \times 1145.11 =$ \$160.32

6. a. $$\begin{array}{r} 3\frac{3}{4} \\ 2\frac{1}{2} \\ +\ \ 5\frac{2}{3} \\ \hline 11\frac{11}{12} \end{array}$$

b. $$\begin{array}{r} 6\frac{2}{5} \\ -\ \ 1\frac{1}{2} \\ \hline 4\frac{9}{10} \end{array}$$

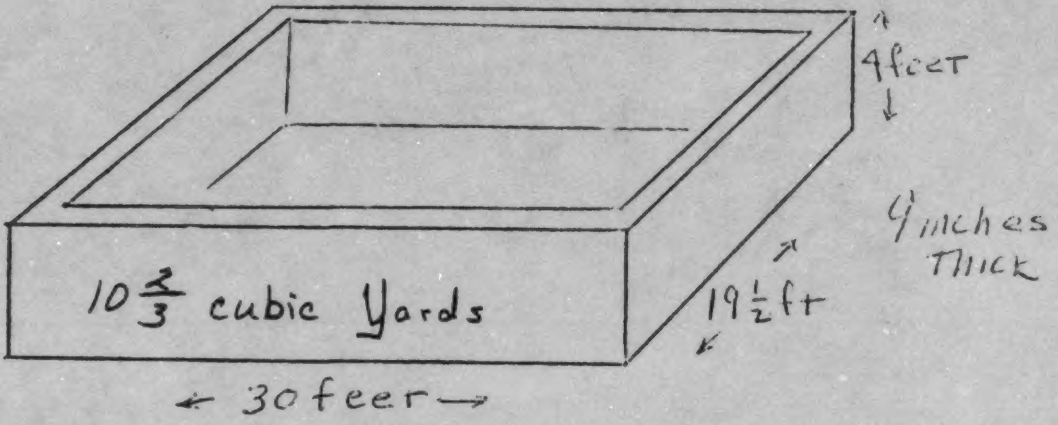
c. $2\frac{3}{4} \times 5\frac{1}{2} = 15\frac{1}{8}$

d. $3\frac{1}{5} \div \frac{4}{5} = 4$

C.O.M.P.
Cement Mason
HE3-1

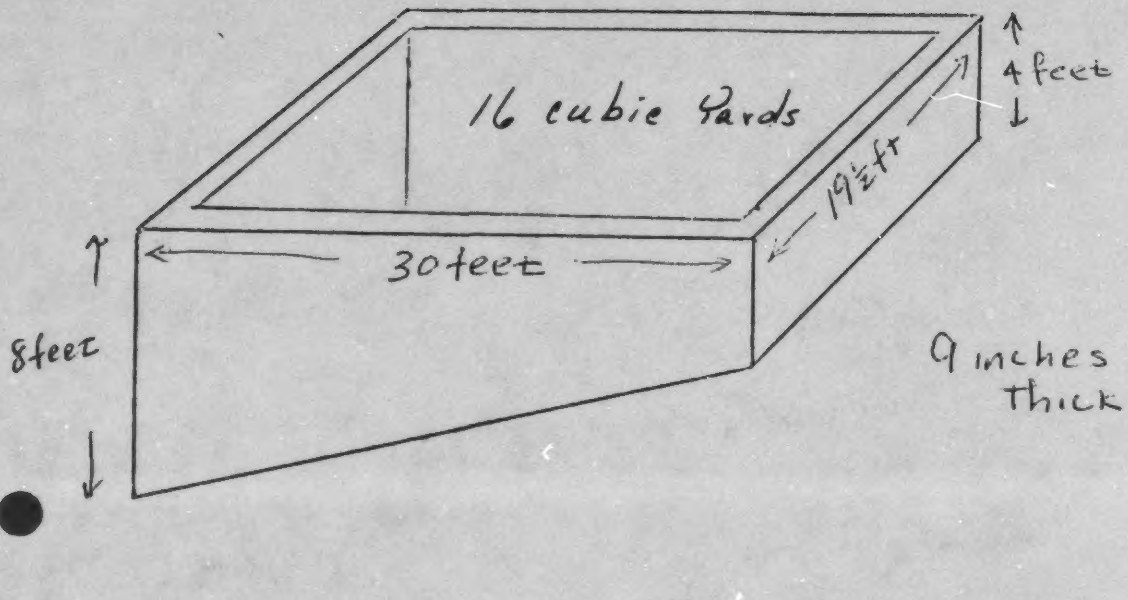
Hour Examination #3
Lessons 10-14

1. Calculate the Volume of cement needed for these foundations.



4 feet
9 inches Thick
19 ½ ft
30 feet

10 $\frac{2}{3}$ cubic yards



4 feet
19½ ft
30 feet
8 feet
9 inches Thick

16 cubic yards

2. Compare the cost of bags of concrete mix:

   a) 68 pounds for \$1.69 makes $\frac{1}{2}$ cubic foot.

   b) 90 pounds for \$2.09 makes $\frac{2}{3}$ cubic foot.

   Which bag gives least cost per pound?
   Which bag gives least cost per cubic foot?
   (SHOW ALL WORK)

68 pound bag	90 pound bag
Cost 2.49¢/lb.	Cost 2.32¢/lb.
3.38¢/cubic foot	3.13¢/cubic foot

3. A cement mason works 6 hours on a small job and uses material worth \$38.50. He charges \$95.00 for the job. How much does he earn per hour on that job?

\$9.42 per hour

4. Would you like to go into an apprentice program? Tell why or why not.

Accept any answers which make sense — the student may of course either "like" or "not like."

5. a.
$$\begin{array}{r} 342 \\ 961 \\ 8{,}243 \\ +\ \ 259 \\ \hline 9{,}805 \end{array}$$

b.
$$\begin{array}{r} 3{,}005 \\ -\ 1{,}987 \\ \hline 1{,}018 \end{array}$$

c.
$$\begin{array}{r} 34 \\ \times\ 96 \\ \hline 3{,}264 \end{array}$$

d.
$$\begin{array}{l} \quad\ \ 36.49 \text{ or } 36\ r128 \\ 261\overline{)\,9{,}524} \end{array}$$

TEACHER'S MANUAL

TEXTILES

General Instructions

1. Use of outside speakers and field trips. Schools and teachers differ in the degree to which they can use speakers and take students from the school on field trips. For this reason the unit is "self contained." However, here are some suggestions for interesting activities which will contribute materially to this unit.

A. Call a Textile Mill in your area and ask the manager if he would speak to the students about a job in the textiles.

B. If possible it would be advantageous to have a group of students visit a mill and report to the class.

2. The "read it in class" feature. The students pages are presented as a connected narrative. Problems grow out of the narrative. This story is to be read in class and, as problems come up, the students stop and work these out. Each day normally will end with a problem set. There are also discussion questions within the story and these should be treated during class time as described in item 3 below. This "read it in class" procedure should be used to contribute to the students growth in reading skill, also.

The narrative is designed to bring up mathematical problems as they might arise on the job, to foster desirable attitudes toward employment, to present realistic employment information, and to give the students a focus for discussion of questions related to careers.

3. The "discussion question"feature. There are a number of questions for discussion. These are marked by an * on the dividing line. These questions point up ideas related to mathematics and careers. When you reach each such question spend some time getting students to think and tell their ideas and opinions.

4. The "Daily Problem" feature. Almost every day a verbal problem or "story problem" will be encountered in the material. This contact with verbal problems on a daily basis will help to overcome students fear and dislike of such problems. Time should be taken in class for (1) students to work independently on the problem and (2) for group discussion and presentation of various solutions.

5. The "It's a Rip Off" feature. Many students enjoy puzzles and problems of a mathematical nature. They may enjoy this aspect of mathematics more than the regualr class work. A problem such as that is presented every two or three days, located at the bottom of the page so the student can "rip it off" and take it home. Class time should be spent on these problems after students have worked

on them, taking about one half hour for each such problem

6. General Review of Underlying Mathematical Processes. (GRUMP). Grump's are short computational assignments given several times each week to prevent forgetting of computational skills.

7. Mission Incredible Assignments. When an assignment involves work outside the school or when only one or two students are needed to do an assignment, such as constructing a demonstration, the assignment is optional for extra credit. It is frequently important to have at least one student do each of these assignments because the information collected or the demonstration constructed will contribute to the class activities.

Materials Needed

Six-inch or one-foot rulers (marked in at least $\frac{1}{16}$")

Textile Employee

Zelda Miller

1. Discussion of Job

When Zelda graduated from high school she decided to find a job in a textile mill. She had several different types to select from in her area. For example there was a rug mill, mens' clothing and a ladies' clothing mills in the area. She wanted to pick the one that she felt the most about so she went to work at a factory that made ladies sports wear. This particular factory produced pant-suits, dresses and other casual wear. What kind of experiences could Zelda havd had in school and at home that would have prepared her for this type of work?

The manager told Zelda she could get the job without experience, since they would train her to do the task she was hired to do. What advantages would there be in having experience?

GRUMP

2.14 + 33.69 + 78.31 + .79 = ____________

$$\begin{array}{r} 56.7 \\ \underline{x.32} \end{array} \qquad \frac{7}{8} \times 2\frac{1}{2} =$$

$$1.6\overline{)272} \qquad 3\frac{1}{2} + \frac{3}{4} =$$

IN THIS DISCUSSION HAVE THE STUDENTS LIST OR STATE WHAT THEY THINK ZELDA WOULD NEED TO KNOW IN ORDER TO HANDLE THE JOB. AFTER THEY HAVE GIVEN THEIR IDEAS HAVE THEM GIVE SOME POSSIBLE SOURSES OF THESE EXPERIENCES. ALSO? DISCUSS REASONS WHY YOU WOULD WANT TO PICK A JOB YOU HAVE SOME QUALIFICATIONS FOR DOING.

IF AT ALL POSSIBLE, THIS WOULD BE A GOOD TIME TO HAVE A MANAGER OF CLOTHING MILL TO SPEAK TO THE CLASS. ALSO, THE HOME-ECONOMICS TEACHER MAY BE ABLE TO CONTRIBUTE SOME IDEAS FOR DISCUSSION

END CLASS HERE

2. Beginning the Job

Zelda began her job as a sewing machine operator. She found out that every body operating a machine did a different part of the outfit being made. For example, one person just sewed on a sleeve, one did the collar, one the lining and so on. Why do you think

MISSION INCREDIBLE

This is your assignment, should you choose to accept it. There are several mills in your area. Get a group of 2 or 3 students together and visit a mill. You will have to get permission to do this. Also, you would need to call the manager for an appointment. You are to find out the following information:

a) What do they make?
b) Do they pay by piece work?
c) Do they have quotas?
d) What are the salaries of the employee?
e) What are some of the jobs available?
f) What kind of experience is helpful?

After gathering this information you should report this to your fellow students.

they did it this way, rather than have one person do the whole outfit. Zelda's task was to sew on the sleeves. Zelda was told how her salary would be figured. The manager said she would be paid $2.10 an hour, plus they would pay her "piece work". This meant she would get paid her regular salary, plus so much per item over her quota. A quota is the number of items that an employee is expected to complete within an alloted time. Zelda's quota is 500 items per week. This means Zelda is required to finish the 500 items before she would start on piece work. Lets look at an example of what one week might look like. Zelda worked a 40 hour week and sewed 600 items what would her salary be for the week? As she gets better at her job, Zelda can increase her weekly salary. In each of the following find out what her weekly pay would be, remember her quota is 500 items.

1. Zelda produced 624 items the second week. What would her pay for the week be?
2. The third week she produced 735 items, what was her total pay?
3. The fourth week Zelda missed a day of work. She worked 32 hours and produced 550 items what was her pay?
4. One week Zelda worked a regular 40 hour week and was paid $100. What was her piece work pay? How many items did she have to do for this extra amount.
5. How many items would she need to complete to earn $25.00 extra. (Hint, don't forget she has to make her quota first.)

THIS IS THE TIME TO DISCUSS "MASS PRODUCTION" OR THE ASSEMBLY LINE APPROACH TO MAKING DIFFERENT PRODUCTS. SOME OF THE REASONS THAT CAN BE BROUGHT FOR USING THIS METHOD ARE, (1) SPEEDS UP PRODUCTION, (2) ITS EASIER TO LEARN JUST ONE JOB, (3) WORKERS SKILL CAN IMPROVE FASTER, (4) ETC. ONE DISADVANTAGE IS THAT SOMETIMES THE PRODUCT IS NOT ALWAYS AS GOOD. HAVE STUDENT SEE IF HE CAN GIVE OTHER IDENTIFICATION

ASK STUDENTS WHY THEY THINK AN EMPLOYER WOULD PAY FOR PIECE WORK.

LET THE STUDENTS GIVE SUGGESTIONS ON HOW THIS SHOULD BE WORKED. GIVE THEM HELP WHERE NEEDED, BUT TRY TO GET THEM TO SOLVE IT.

SOLUTION:

(A)

REGULAR SALARY $2.10
X 40
$84.00

(B)

ITEMS COMPLETED - QUOTA
600 - 500 = 100

(c) SINCE SHE HAS 100 OVER HER QUOTA SHE WILL GET 100 X $.10 = $10.00

(D) THUS, HER WEEKS SALARY IS:

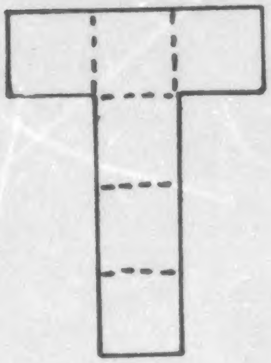
REGULAR SALARY	$84.00
PIECE WORK	$10.00
TOTAL	$94.00

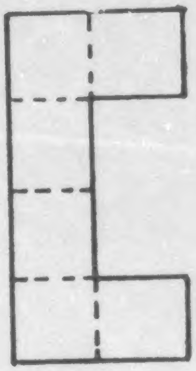
ASSIGN PROBLEMS AT END OF DISCUSSION OF EXAMPLE.

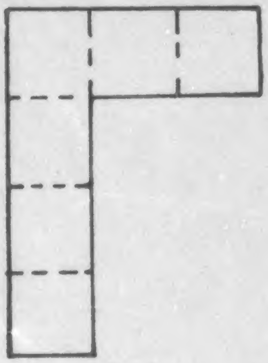
END CLASS HERE

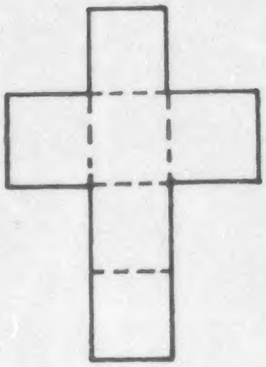
IT'S A RIP OFF!

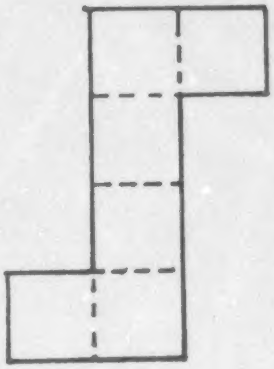
Each of the following patterns are made-up of six squares. If you are only allowed to cut on the solid lines (not the dotted), how many of these patterns could be folded so they make a cube.

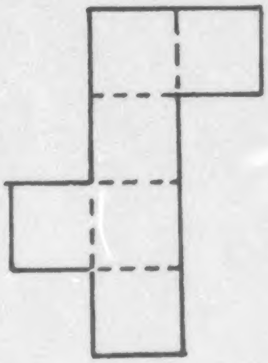


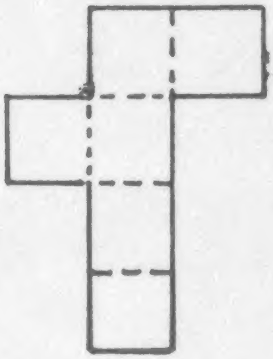






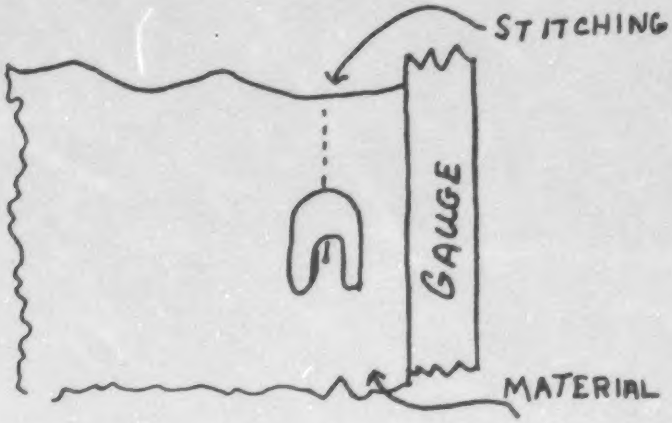






3. Setting the Seam Gauge

One of the most important parts of sewing is the proper setting of the seam gauge. This gauge determines how far in the stitching will be on the material. If the gauge is set at the wrong place the size of the garment will not be correct and this would cause the item to be wasted.



This gauge is varied to make the garment the correct size. The gauge will usually vary from 1/2" for large sizes to 1 1/4" for smaller sizes. Therefore, it is necessary for a machine operator to be able to read a ruler to the nearest sixteenth of an inch.

Zelda was told that she was to set the gauge as accurately as she could. Do you think she could have been exact in the measurements?

Measure the following ling segment to the nearest inch.

Now that you have discussed the above problem measure the following line segments to the nearest inch.

a. ans.____________

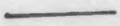
FOR THE EXERCISE THE STUDENTS WILL NEED TO HAVE A RULER TO COMPLETE THE TASK.

DISCUSS THIS QUESTION WITH THE STUDENTS. BRING OUT THE FACT THAT NO MEASUREMENT IS EXACT. USE EXAMPLES OF OTHER MEASUREMENT SITUATIONS TO ILLUSTRATE THIS CONCEPT.

AFTER THE STUDENTS HAVE MEASURED THE LINE, HAVE THEM GIVE THE ANSWER. THEY SHOULD HAVE GOTTEN 3 IN. (TO THE NEAREST INCH) ASK THEM WHY IT WOULD BE 3 INCHES RATHER THAN 2. AN ACCEPTABLE ANSWER WOULD BE THAT ITS CLOSER TO 3 INCHES THAN 2 INCHES. NOW HAVE THEM MEASURE THE OTHER LINE SEGMENTS TO THE NEAREST INCH.

b. ans.__________

____

c.  ans.__________

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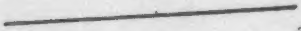
d.  ans.__________

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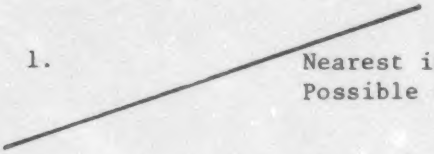
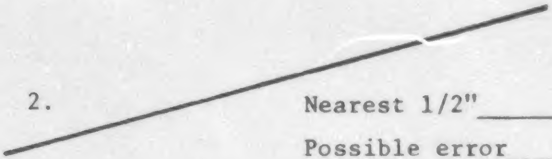
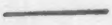
Problems:

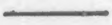
In each of the following problems measure the line segment to the nearest unit indicated. Also, give the fractional part of your measurement could be off (possible error.)

Example:

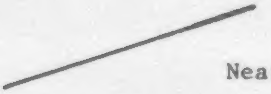
1. 
Nearest inch___3"___
Possible error_1/2"_

2. 
Nearest 1/2"________
Possible error______

3. 
Nearest 1/4"________
Possible error______

4. 
Nearest 1/8"________
Possible error______

5.
Nearest 1/16"________
Possible error______

6. 
Nearest 1/2"________
Possible error______

FOR DISCUSSION PURPOSES AND REAL EXAMPLE, IT WOULD BE A GOOD IDEA TO BRING SOME PATTERNS OF DRESS, PANTS, ETC. MEASUREMENTS COULD BE MADE USING THESE PATTERNS.

END CLASS HERE

AFTER EACH STUDENT HAS COMPLETED THE MEASUREMENTS TASK CHECK THE ANSWERS AND THEN CONTINUE WITH THE FOLLOWING QUESTION.

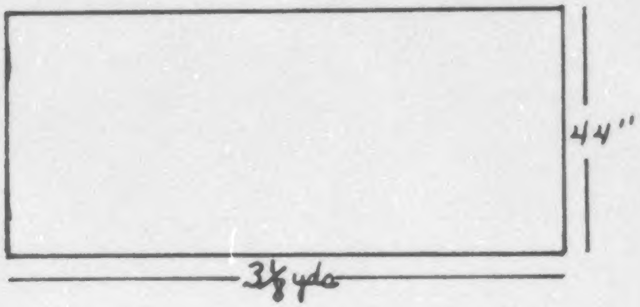
IF I MESURED A LINE SEGMENT AND I TOLD YOU IT WAS 2" (TO THE NEAREST INCH) HOW LONG COULD IT REALLY BE? WE ARE HOPING THEY WILL SAY ANYWHERE FROM 1 1/2" TO 2 1/2" LONG. CONTINUE WITH OTHER EXAMPLES UNTIL THE STUDENTS UNDERSTAND THAT, IF WE MEASURE TO THE NEAREST INCH WE CAN BE "OFF" 1/2" EITHER WAY (± 1/2"). AFTER THIS DISCUSSION HAVE THEM CONTINUE AND MEASURE THE SAME LINE SEGMENTS TO THE NEAREST 1/2". ONCE THEY HAVE FINISHED CONTINUE THE DISCUSSION AS YOU DID FOR THE NEAREST 1" MEASUREMENTS. HOWEVER, IN THIS CASE THEY SHOULD SEE THAT THEY CAN BE OFF 1/4" IN EITHER DIRECTION. THAT IS A MEASUREMENT, TO THE NEAREST 1/2" OF 2" COULD BE 1 3/4" TO 2 1/4". THIS PRESENTATION SHOULD CONTINUE, UNTIL THE STUDENTS SEE THAT MEASURING THE POSSIBLE ERROR IS 1/2 OF THE SMALLEST UNITS WE ARE OFF ± 1/2", TO THE NEAREST 1/2" WE ARE OFF ± 1/4", TO THE NEAREST 1/4" WE ARE OFF ± 1/8 ETC. AFTER COMPLETING THIS DISCUSSION ASSIGN THE STUDENT THE MEASURING EXERCISE.

4. Pattern Cutter and Marker

Before any sewing can be done it is necessary for someone to lay out the desired pattern and to make sure it is cut properly. This particular job can pay as high as $6.00 an hours. Can you think of any reasons why this job should pay so much more than that of a sewing machine operator. It is the responsibility of the "pattern marker" to select the material from stock and to lay out the pattern with the least amount of waste as possible. This is so that as many garments as possible can be obtained from a roll of material.

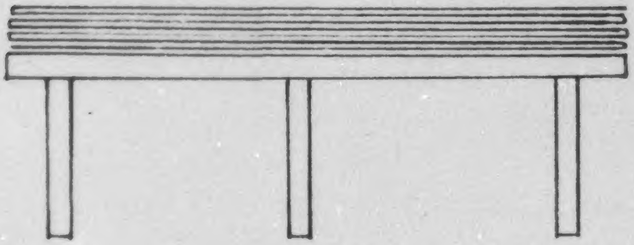
TRY TO GET THE STUDENTS TO UNDERSTAND THE EXTRA RESPONSIBILITY ATTACHED TO THIS JOB. IF THE PATTERN IS CUT INCORRECTLY IT CAN BE VERY COSTLY TO THE MILL OR THE PROPER SIZES WOULD NOT BE OBTAINED. OTHER REASONS SHOULD BE BROUGHT OUT BY THE STUDENTS.

Material comes in large rolls and is measured in terms of linear yeards. The smallest unit of measure used varies, but is usually 1/8 of a yard or 1/10 of a yard. The width of the material is also in standard widths. These are usually 36", 44" and 60". Thus, when selecting material you have to think of two measurements, what width do you need and how long. For example if a pattern calls for 3 1/8 yards of 44 inch material it would look like this:



BEFORE YOU GO ON YOU MAY WISH TO REVIEW THE IDEA OF LINEAR MEASURE.

Of course in a clothing mill the cutter does not just work with just one outfit at a time. He will lay out an entire roll of material on a large cutting table before he lays out the pattern. An illustration of the material lay out follows:



Once he has layed out the material he would roll out the pattern on top of the material, mark the pattern and then cut through all of the material at once. As you can see, he would be cutting out a large number of outfits at one time.

Look back at this illustration above and find out how many lanier yards of material there are in the layout (there are 7 layers of material, 45 feet each).

If a pattern called for 3 yards of this material, how many outfits would you get from this layout?

Problems:

In each of the following problems we will use the same table as in the illustration (45' long).

1. If the pattern cutter layed out 12 layers of material and each dress required 3 1/2 yards of material, how many dresses can he get in this situation?
2. There were 15 layers of material on the table. Each pant suit required 4 yards, how many pant suits can be obtained?

BE SURE THE STUDENTS SEE A PATTERN AT THIS TIME: IF POSSIBLE IT WOULD BE GOOD TO SET SOME FROM A LOCAL FACTORY.

AFTER ALLOWING SOME TIME TO WORK, HELP THE STUDENTS GO THROUGH THE PROBLEM. GET THEIR SUGGESTIONS AND IDEAS ON HOW IT SHOULD BE SOLVED.

(A) AMOUNT OF MATERIAL IN FEET:

7 X 45' = 315'

(B) AMOUNT OF MATERIAL IN YARDS.

315 ÷ 3' = 105 Yards

Number of Outfits

105 Yards ÷ 3 = 35

BEFORE ASSIGNING THE PROBLEMS WORK ANOTHER EXAMPLE IN CLASS WITH THE STUDENTS.

END CLASS HERE

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3. Find the number of layers of material, if the cutter had layed out 270 yards of material.
4. If 81 yards of material had been layed out and an outfit required 3 1/8 yards, how many can be cut. Would there be any waste?
5. How many outfits, requiring 4 1/4 yards each, can be cut from 320 yards of material. Would there be any waste?

IT'S A RIP OFF

Look a the addition problem below. Replace each of the □ with the same digit, so the sum is correct.

$$\begin{array}{r} 3,\square 5\ 2 \\ 1,0\ 7\ \square \\ 5,4\ \square\ 2 \\ \underline{\square,7\ 3\ \square} \\ 1\square,9\ 2\ \square \end{array}$$

5. Cost of Garments

When a company sells a garment they must take into account what it cost them to make it. This includes wages payed to workers, over head (rent, lights, heat, etc.) and the cost of material. For example, a dress takes 4 1/8 yards of material and the material cost $3.28 a yard. The material cost for the dress is:

$$\$3.28 \times 4\ 1/8 = \frac{\$3.28}{1} \times \frac{33}{8} = \frac{108.24}{8} = \$13.58$$

What would the material cost for a pair of pants, if the pants require 3 1/4 yards of material costing $2.75 per yard?

Can you think of any thing else that would go into the cost of making clothing? Now that you have discussed some of the items that add to the cost of making clothes, find the cost of each of the following pieces of wearing apparel.

1. To make a pair of men's pants it requires the following:
   3 1/4 yards of material at $2.40 per yard
   1 zipper at 50¢
   3 buttons, 5¢ each
   Find the total cost of material.
2. The material required for a ladies blouse is:
   2 1/2 yards of material at $1.75 per yard
   6 buttons at 3 for 10¢
   1 1/2 yards of interfacing 50¢ per yard
   Find the cost of materials.
3. A ladies pant suit requires
   1 zipper 42¢
   6 1/2 yards of material at $2.15 per yard
   3 1/2 yards of lining at $1.15 per yard
   2 yards of interfacing at 50¢ per yard
   What is the total cost of material?

THIS TYPE OF PROBLEM MAY CAUSE SOME DIFFICULTY, SINCE WE ARE MULTIPLYING A DECIMAL FRACTION BY A COMMON FRACTION.

DISCUSS THE ILLUSTRATED SOLUTION AND THEN HAVE THE STUDENTS ATTEMPT THE NEXT EXAMPLE.

SOLUTION TO EXAMPLES:
THIS PROBLEM MAY BE SOLVED IN THE FOLLOWING WAYS:

1) $2.76 X 3 1/4

$$= 2.76 \times \frac{13}{4}$$

$$= \frac{\overset{69}{\cancel{2.76}}}{1} \times \frac{13}{\cancel{4}_{1}}$$

$$= .69 \times 13 = \$8.97$$

2)
```
$2.76        $2.76
 X3 1/4       3.25
             13 80
             552
            828
            $8.9700
```

DISCUSS THESE SOLUTIONS AND ANY ATTEMPT THAT A STUDENT MAY HAVE.

IN TALKING ABOUT THE COST OF CLOTHING MAKE SURE THAT ITEMS SUCH AS BUTTONS, ZIPPERS, AND THREAD ARE INCLUDED IN THE DISCUSSION.

END CLASS HERE

Mission Incredible

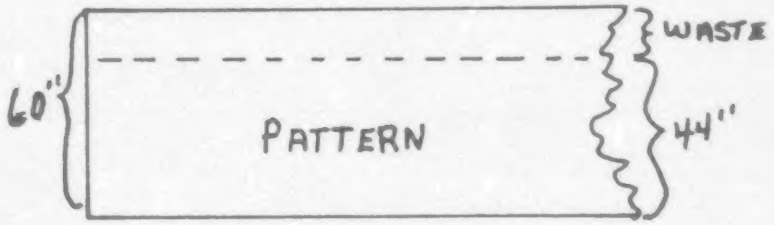
This is your assignment, should you choose to accept it. You are to bring a pattern from home or go to a "sewing center" and look at a pattern and answer the following.

a) How much material does it require?
b) What other items are needed to finish the article of clothing?
c) Find out the price of materials.
d) Compute the cost of making the garment.

Bring back this information to class and share your results. How does the cost compare to buying the articles in a store?

6. Waste

There are several ways that waste of material can occur, but one of the most costly is to use material too wide for the pattern. For example, if the pattern calls for 44 inch material and the cutter uses 60 inch material, he is wasting a strip of material 16" wide.



Can you find out how many square feet of material he would waste if the piece he is cutting is 45 feet long?

Example 2

If the material is 44 inches wide and the pattern called for 36 inch, what would be the number of square feet wasted on a piece 80 feet long?

Problems:

Find the number of square feet of waste in each of the following

	Pattern width	Material width	Material length
1	44"	60"	150ft
2	36"	44"	210ft
3	36"	60"	110ft
4	36"	44"	500ft

5. **If the material, in each of the above, cost 60¢ a square foot, what is the cost of the waste in each of the four problems?**

SOLUTION

1) CHANGE 16" to 1 1/3 Feet
2) Multiply 45 X 1 1/3
= $\frac{45}{1}$ X $\frac{4}{3}$ = 15 X 4 = 60 SQ.Ft.

OR 1) CHANGE 45 FEET TO INCHES
45 X 12 = 8640 SQ. IN.

2) 540" X 16" = 8640 SQ. IN.

3) DIVIDE BY THE NUMBER OF SQ. IN. IN A SQ. FT. 8640 ÷ 144 = 60 SQ. FT.

THIS SECOND WAY IS MORE DIFFICULT, HOWEVER IF SUGGESTED BY THE STUDENTS IT SHOULD BE DISCUSSED.

EXAMPLE 2.
1) 44" - 36" = 8" WASTE
2) 8" = 2/3 FT
3) 80 Ft X 2/3 = 160/3
= 53 1/3 SQ.FT.

TEACHER'S MANUAL

BEING SELF-EMPLOYED:
HARVESTING AND SALE OF PULPWOOD

General Instructions

1. Use of outside speakers and field trips. Schools and teachers differ in the degree to which they can use speakers and take students from the school on field trips. For this reason the unit is "self contained." However, here are some suggestions for interesting activities which will contribute materially to the unit.

A. Have an outside speaker who has a practical working knowledge of the pulpwood industry speak to the class. The state forestry department local office may be able to supply such a speaker. The agriculture teacher or leader of the local Future Farmers of America will be able to supply information.

B. Spend a day or part of a day touring the forestry industry locally. This may include observation of logging in the forest, a visit to a pulpwood yard and a visit to a paper mill. Be sure you have a knowledgeable person conduct this tour and that advance permission is obtained from all places you plan to visit.

2. The "read it in class" feature. The students pages are presented as a connected narrative. Problems grow out of the narrative. This story is to be read in class and, as problems come up, the students stop and work these out. Each day normally will end with a problem set. There are also discussion questions within the story and these should be treated during class time as described in item 3 below. This "read it in class" procedure should be used to contribute to the students growth in reading skill, also.

The narrative is designed to bring up mathematical problems as they might arise on the job, to foster desirable attitudes toward employment, to present realistic employment information, and to give the students a focus for discussion of questions related to careers.

3. The "discussion question" feature. There are a number of questions for discussion. These are marked by an * on the dividing line. These questions point up ideas related to mathematics and careers. When you reach each such question spend some time getting students to think and tell their ideas and opinions.

4. The "Daily Problem" feature. Almost every day a verbal problem or "story problem" will be encountered in the material. This contact with

verbal problems on a daily basis will help to overcome students fear and dislike of such problems. Time should be taken in class for (1) students to work independently on the problem and (2) for group discussion and presentation of various solutions.

5. *The "It's a Rip Off" feature*. Many students enjoy puzzles and problems of a mathematical nature. They may enjoy this aspect of mathematics *more* than the regular class work. A problem such as that is presented every two or three days, located at the bottom of the page so the student can "rip it off" and take it home. Class time should be spent on these problems *after* students have worked on them, taking about one half hour for each such problem.

6. *General Review of Underlying Mathematical Processes*. (GRUMP). Grump's are short computational assignments given several times each week to prevent forgetting of computational skills.

7. *Mission Incredible Assignments*. When an assignment involves work outside the school or when only one or two students are needed to do an assignment, such as constructing a demonstration, the assignment is optional for extra credit. It is frequently important to have at least one student do each of these assignments because the information collected or the demonstration constructed will contribute to the class activities.

Being Self-Employed:
Harvesting and Sale of Pulpwood.

Mike Stewart

1. Beginning to Learn The Business

When Mike Stewart left high school he went to work for a pulpwood producer. A pulpwood producer is a man who cuts wood in the forest and transports it to a pulpwood yard. He may work with two other men or he may have several crews working at the same time. When he brings his pulpwood to the yard he will sell it to a dealer who delivers it to a paper mill.

Mike earned $1.75 per hour cutting and loading pulpwood in the forest. He went with Mr. Sams each day in his truck and cut down trees, trimmed the branches and stacked them on the truck using a "big stick loader". Mike liked this job because he liked to operate machinery and work out doors. He always felt good in the woods. Would you like this kind of job? Mike thought that he might make more money if he ran the crew, rather than working for someone else. What would Mike gain by going into business for himself? What would he loose?

If Mike decides to go into the pulpwood business for himself, what should he know about the business? Discuss this and make a list of the things you think Mike should know.

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IN THIS DISCUSSION YOU MAY BRING OUT THE TRADE: BEING SELF-EMPLOYED MEANS LESS SECURITY, MORE RISK, BUT THE CHANCE OF HIGHER INCOME.

THERE ARE SO MANY THINGS IT WILL BE IMPOSSIBLE TO LIST ALL OF THEM. COST OF EQUIPMENT SUCH AS TRUCK, SAWS, LOADER ETC., COST FOR USE OF LAND (BUYING A MANS STANDING TREES), PRICE OF SALE OF THE SAWED WOOD ETC. ALL THESE FACTORS WILL DETERMINE WHETHER A MAN CAN MAKE A PROFIT.

GRUMP

435
3,297
85
+ 651

3,407
- 1,988

259/ 85,961

238
x 47

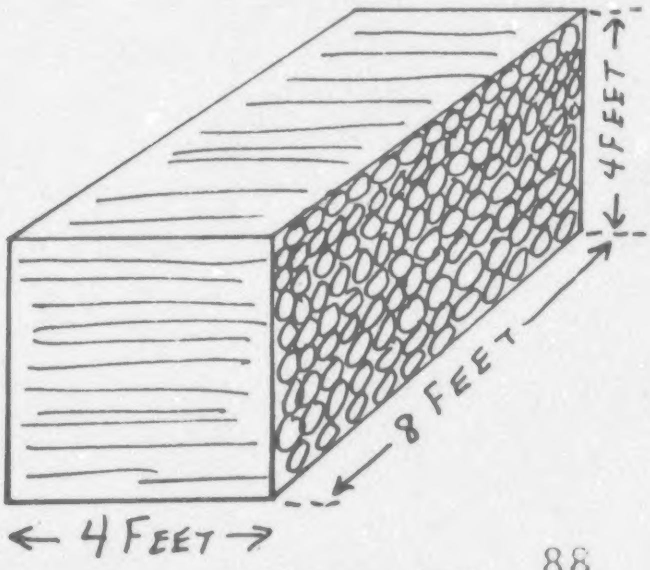
END CLASS HERE

2. Harvesting By The Cord

Mike began to watch the business very closely. He knew that he would need all the knowledge and all the experience he could get to make a profit when he went into business for himself. "If a man with money meets a man with experience, the man with the experience gets the money and the man with the money gets the experience."

YOU MAY WISH TO DISCUSS THIS WITH THE STUDENTS, OR YOU MAY WISH TO IGNORE IT.

He observed that wood is measured by a unit called a cord. One cord of wood is a stack 4 feet high, 4 feet wide and 8 feet long. The wood is in the form of round logs.



ONE CORD

Of course, you wouldn't find a cord stacked this neatly most of the imte. This is just to give you the idea. How many cubic feet are in the dimensions of a cord?

4' X 4' X 8' = 128 CUBIC FEET

How many cords of wood are in each of these stacks?

1. A stack 4 feet high, 8 feet long and 6 feet wide.

2. A stack 6 feet high, 12 feet long and 4 feet wide.

   2 1/4 CORDS

3. A stack cut for fireplace wood: 5 feet high, 10 feet long and 18 inches wide.

   AS A DECIMAL .59 CORDS
   AS A FRACTION $\frac{75}{128}$ ESTIMATE: "A LITTLE MORE THAN HALF A CORD."

4. A stack of long logs: the logs are 10 feet long and they are stacked in a pile 6 feet wide and 4 feet high.

   DECIMAL: 1.875 CORDS
   FRACTION: 1 7/8 CORDS

5. A stack 12 feet long, 5 1/2 feet wide and 3 feet high.

   DECIMAL: 1.55 CORDS
   FRACTION: $\frac{99}{64} = 1\frac{35}{64}$ CORDS

6. A stack 10 feet long, 4 feet wide and 2 1/2 feet high.

   DECIMAL: .78 CORDS
   FRACTION: $\frac{25}{32}$ CORDS

GIVE THE STUDENTS TIME TO FIGURE THIS OUT. A FEW MINUTES SHOULD BE ENOUGH IF THEY HAVE STUDIED VOLUME IN FORMER UNITS. IF NOT, STOP HERE AND TEACH OR RE-TEACH VOLUME.

YOU MAY WISH TO WORK A SAMPLE PROBLEM.

#1. V = L X W X H
= 8FT. X 6FT. X 4FT.
= 192 CUBIC FEET.

1 CORD = 128 CUBIC FEET

$\frac{192}{128} = 1\frac{1}{2}$ SO THE STACK OF WOOD IN PROBLEM 1 IS EQUAL TO 1 1/2 CORDS.

DECIMAL ANSWERS ARE EASIER TO OBTAIN FOR THESE PROBLEMS.

END CLASS HERE

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3. Units for Cutting and Sale

When cutting trees in the woods Mike was told to cut longs 5 foot 3 inches long. Mike said "Wouldn't it be easier to figure cords if we cut the logs 4 feet long?" Mr. Sams said, "It would be but we can't sell our wood unless we cut it 5 feet 3 inches long. The wood dealer would not buy it any other length." Can you guess why pulpwood is all cut in 5 foot 3 inch lengths? What reasons could there be for this? Think of the places you have seen wood stacked. What is done with it?

EVERYTHING HAS ITS REASON. IN THIS CASE THE 5 FOOT 3 INCH LENGTH WILL JUST FIT IN 2 ROWS ON A RAILROAD CAR, MAKING A 10 1/2 FOOT WIDE LOAD. THE MACHINERY AT THE PULPWOOD PLANT IS DESIGNED TO HANDLE LOGS OF THIS SIZE.

GIVE THE STUDENTS TIME TO COMPUTE. HAVE DIFFERENT STUDENTS PUT PARTS OF THE ANSWER ON THE BOARD.

A cord is a stack of wood which is 4 ft. x 4 ft. x 8 ft. How many cords in a stack which is 4 feet high, 5 feet 3 inches wide and 8 feet long?

4' X 5 1/4' X 8' = 168 CUBIT FEET

168 CUBIC FEET = 1 5/16 CORDS = 1.31 CORDS

(Remember The Answer)

In some areas, wood is sold by the "unit". A unit is a pile 4 feet x 5 ft. 3 in. x 8 ft. It is like a cord, except of course it is larger than a cord. How much bigger is a "unit" than a cord? What could you use as a "multiplying factor" to change units to cords?

ANSWER IS 40 CUBIC FEET LARGER OR 1 5/16 TIMES AS LARGE.

THIS IS A HARD ONE. YOU MAY HAVE TO PROVIDE LOTS OF HELP FOR THE STUDENTS TO GET THIS ANSWER.

UNITS TO CORDS: MULTIPLY UNITS BY $\frac{16}{21}$ OR BY 1.31

How would you change cords to units?

CORDS TO UNITS: MULTIPLY CORDS BY $\frac{16}{21}$ OR BY .75.

Wood is also sold by the ton, by the unit, by the cord and by the "cunit". A ton is 2,000 lb., a unit is a pile 4' x 5'3" x 8', a cord you already know, and a cunit is 100 cubic feet. This varies widely from place to place.

MISSION INCREDIBLE

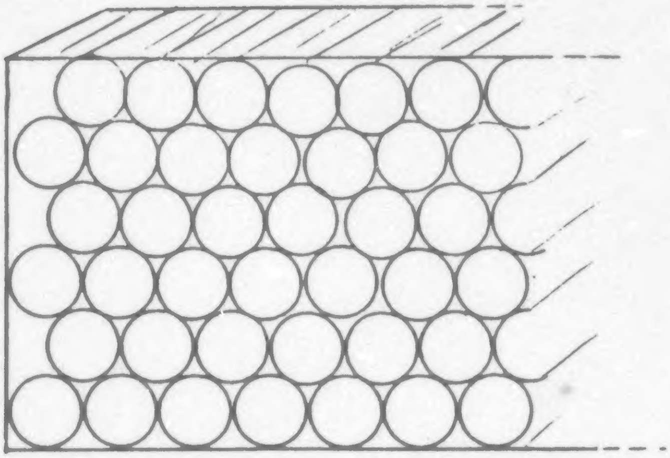
1. This is your assignment, should you choose to accept it. A cord of wood is not all wood. There are air spaces around the logs which are not filled with wood. Find the volume of wood and the volume of air in a stacked cord of wood.

Volume of a cord 128 CUBIC FEET

Volume of wood 90% WOOD: 115.2 CUBIC FEET

Volume of air 10% AIR: 12.8 CUBIC FEET

Suggestion: Assume a cord is made of all the same size sticks, round and stacked like this



(THIS IS A HARD PROBLEM. MANY STUDENTS WHO TRY THIS WILL BE UNABLE TO COME UP WITH THE ANSWER. THE FOLLOWING ACTIVITY IS MUCH EASIER.)

2. Collect enough small sticks to make a "scale model" of a cord of wood. You might make your model 1 foot long by 6 inches high by 6 inches wide. Bring this for display in class.

One unit of pine pulpwood is equal to 7,022 lb. What is the weight of a cunit of pulpwood? What is the weight of a cord of pulpwood. What is the weight of a ton of pulpwood.

CUNIT: 4,180 LB. (ROUNDED)
CORD: 5,350 LB. (ROUNDED)
TON: 2,000 LB. (OF COURSE)

AGAIN, THIS IS A DIFFICULT PROBLEM. GIVE TIME AND HELP WHERE NEEDED.

GRUMP

$$\begin{array}{r} 2\frac{3}{4} \\ +\ 5\frac{5}{6} \\ \hline 8\frac{7}{12} \end{array} \qquad \begin{array}{r} 4\frac{2}{3} \\ -\ 1\frac{4}{5} \\ \hline 2\frac{13}{15} \end{array}$$

$$3\frac{2}{5} \times 1\frac{1}{2} = 5\frac{1}{10}$$

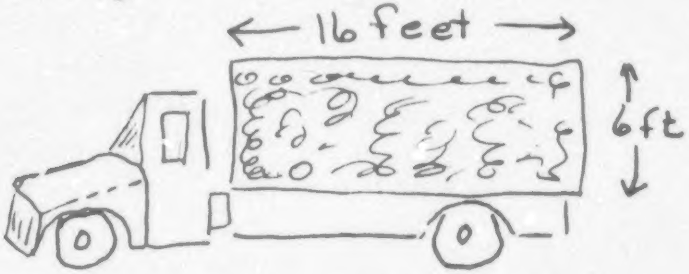
$$4\frac{2}{3} \div 1\frac{3}{5} = 2\frac{11}{12}$$

END CLASS HERE

---

4. How Much Is Your Wood Worth?

When Mike went with Mr. Sams to the pulpyard he watched the man measure the wood while it was on the truck. The bet of the truck was 16 feet long the the wood was piled about 6 feet high.



The wood was cut to the standard 5 foot 3 inch length. The man at the wood yard did some calculations on an old envelope on the hood of the truck. He turned to Mike and said "How many cords do you reckon this is, Mike?" Mike said "I have it figured to

WE ALREADY KNOW THAT A UNIT IS 1 5/16 or 1.3 CORDS. ON THE TRUCK WE HAVE ABOUT 3 UNITS (16' X 6' X 5'3"). 3 UNITS X 1.3 = 3.9 CORDS HOW DO WE KNOW THIS IS 3 UNITS?

about ____________." Can you fill in the number of cords for Mike? Work it out.

Mr. Sams showed Mike the ticket and the check when he came out of the office. Look at the ticket on the next page. Look now!

Have you examined the form? What questions would you want to ask about the ticket? List your questions here.

WHAT IS STUMPAGE AND WHO GETS IT? WHAT ARE THE "TRUCK" AND "SAW" DEDUCTIONS AND WHO GETS THE MONEY?

____

____

Mr. Sams gets $33.00 per cord before deductions. This figure will vary widely from place to place. Close to a mill where wood is scarse a producer may get more than this. In the mountains of North Georgia where there is plenty of wood and no mills a producer may get much less. Calculate the pay, at $33.00 per cord for the following loads. All the wood in these loads is cut 5'3" long.

1. A truck 18 feet long loaded 4 feet high.

   2.95 CORDS ⟶ $97.45

2. A truck 12 feet long loaded 4 feet high.

   3.94 CORDS ⟶ $129.94

3. A truck 20 feet long loaded 5 feet high.

   4.1 CORDS ⟶ $135.35

4. A truck 16 feet long loaded 8 feet high.

   5.25 CORDS ⟶ $173.25

5. A truck 20 feet long loaded 6 feet high.

   4.92 CORDS ⟶ $162.42

DO THAT IN YOUR HEAD: A UNIT IS 8' X 4' X 5'3". THIS IS 2 TIMES LONGER AND 1 1/2 TIMES TALLER SO 2 X 1 1/2 = 3 UNITS ON THE TRUCK.

TRY TO START DISCUSSION HERE. THE MAIN THING IS "WHERE DID ALL THE MONEY GO?" THE QUESTIONS WHICH MIGHT COME UP ARE LISTED HERE BUT IF STUDENTS THINK OF OTHER BE SURE TO INCLUDE THEM IN YOUR DISCUSSION.

AS YOU HAVE THE STUDENTS READ THIS, REFER THEM BACK TO THE FORM AND POINT OUT THE FIRST CALCULATION, MULTIPLYING THE NUMBER OF CORDS BY $33.00.

FIRST FIND HOW MANY CORDS IN THE LOAD, THEN MULTIPLY BY $33.00. HAVE STUDENTS WORK THE FIRST ONE ON THE BOARD.

END CLASS HERE

Stumpage
Name J. J. Manning
Rate 18 / cord

VALDOSTA PULPWOOD YARD
Rt. 4, Box 297
Valdosta, Georgia

Producer Me. L. Sams
Cords: 3.9 x $33.

Total $128.70
Stumpage 70.20
Truck 7.80
Saw 1.95
Account —o—
Total Ded. 79.95
Paid 48.75

VALDOSTA PULPWOOD YARD
Rt. 4, Box 297
Valdosta, Georgia

VALDOSTA CENTRAL BANK
April 12, 1974

Pay To The Order Of L. Sams $ 48.75
Exactly Forty eight and 75/100 dollars

XXX SAMPLE XXXXXXXXXXXXXXXXXXXXXXXX

096-082-04-00

It's A Rip Off

Do these addition problems: When you see a pattern or a short cut, stop adding and use the short cut!

1 = ____
1 + 3 = ____
1 + 3 + 5 = ____
1 + 3 + 5 + 7 = ____
1 + 3 + 5 + 7 + 9 = ____
1 + 3 + 5 + 7 + 9 + 11 = ____
1 + 3 + 5 + 7 + 9 + 11 + 13 = ____
1 + 3 + 5 + ... (50 odd numbers) ... + 99 = ____

Doggone!

that's TOO ODD FOR ME

5. Financing Truck and Saw

Mike wondered about the deductions for truck and saw on the Pulpwood Receipt. Mr. Sams explained that he bought the truck and the saws he was using on "time". The credit was arranged so that the payment was deducted from the money he was paid for the wood.

"How much do they take out?", Mike asked. Mr. Sams explained that they take a certain amount per cord of wood he sells. Using the pulpwood receipt, calculate the deduction for each cord of wood for the saw and the deduction for the truck.

GIVE THE STUDENTS TIME TO WORK THIS OUT.

SAW: $\frac{\$1.95}{3.9\text{ CORDS}}$ = .50 PER CORD

TRUCK: $\frac{\$7.80}{3.9\text{ CORDS}}$ = $2.00 PER CORD

Mr. Sams Paid $225.00 for each of the 3 saws they use on the job. He put 25% down and the remainder is being deducted from his earnings at the rate you figured above. How many cords will Mr. Sams have to cut to pay for the saws at that rate?

3 SAWS AT $225.00 =	$675.00
25% DOWN:	168.75
75% LEFT TO PAY	506.25
AT 50¢ PER CORD:	$1,012 1/2 CORDS.

Mr. Sams paid $2,400.00 for a used truck when he went into the business. How many cords of wood will he have to cut to pay for the truck?

$2,400 AT A RATE OF 2.00 PER CORD. IT WILL TAKE 1.200 CORDS TO PAY IT OFF.

GRUMP

43 + 982 + 1,256 + 85 + 273 = 2,639

43,072 - 9889 = 33,183

2,437 x 198 = 482,526

2,946 ÷ 157 = 18.76 OR 18 R120

END CLASS HERE

MISSION INCREDIBLE

Here is your mission, should you choose to accept it. You and 1 or 2 friends check the yellow pages under saws and list several places in your town where chain saws are sold. Visit one of these places and, when the salesman is not busy, explain to him that you are studying the pulpwood business and would like to look at a good chain saw.

Plan the questions you want to ask about it. Bring the information back to class. Here are some questions you might ask:

How much does it cost?
If you can't pay it all, can it be financed?
How long will it last in steady use?
What safety features does it have?

6 & 7. Stumpage, Acres

"Stumpage" is the money paid to the owner of the land on which the wood is growing. Stumpage is very different in different sections of the country and even in different parts of the state. In Georgia it may vary from less than \$9.00 per cord to more than \$30.00 per cord. Try to think of reasons why the price paid for this basic resource should vary so much in Georgia. Discuss. List your reasons:

THIS LESSON WILL VERY LIKELY TAKE 2 OR MORE DAYS TO GET THROUGH.

TRY TO USE THIS DISCUSSION TO BRING OUT THE LAW OF "SUPPLY AND DEMAND". IN SOUTH GEORGIA THERE IS LITTLE PULPWOOD GROWN AND MANY MILLS TO BUY IT. IN NORTH GEORGIA THE LAND IS "ALL WOOD" AND THERE ARE NO LOCAL MILLS.

ANOTHER REASON IS COST TO SHIP TO THE MILLS. WHERE THE COST IS HIGH, THE WOOD WILL BE WORTH LESS.

As Mike and Mr. Sams worked on various jobs, Mike learned about the economics of growing the wood, as well as harvesting it. Mike was told by a tree farmer that most "planted" forest land would produce 10 to 15 cords per acre, more or less, depending on the land. Mike wasn't too clear about acres so he looked it up. You look up the definition of acre and write it here?

AN ACRE IS NOW STANDARDIZED AT 43,560 SQUARE FEET.

Now, you know what an acre is compared to a square foot. How big is an acre compared to a square

YOU MAY NEED TO REVIEW THE DEFINITION OF A SQUARE MILE. ALLOW TIME FOR THE STUDENTS TO COMPUTE.

mile? Is it larger or smaller than a square mile? How many acres in one square mile?

AN ACRE IS MUCH SMALLER THAN A SQUARE MILE. A SQUARE MILE IS 640 ACRES.

Calculate the number of acres in each of the following areas.

1. 475 feet x 850 feet
   - a. Estimate 9 ACRES
   - b. Answer 9.27 ACRES
2. 2,570 feet x 1,400 feet
   - a. Estimate 75 ACRES
   - b. Answer 83.6 ACRES
3. 1,500 feet x 950 feet
   - a. Estimate 35 ACRES
   - b. Answer 32.7 ACRES
4. 350 feet x 1,975 feet
   - a. Estimate 17 ACRES
   - b. Answer 15.9 ACRES
5. 2,750 feet x 1,750 feet
   - a. Estimate 110 ACRES
   - b. Answer 110.5 ACRES

(ANSWERS TO THIS SET HAVE BEEN ROUNDED TO THE NEAREST TENTH ACRE.)

DISCUSS THE IMPORTANCE OF ESTIMATING. OFTEN AN EXACT ANSWER IS NOT REQUIRED. PROBLEM 1 MAY BE DONE THIS WAY.

475 500 (UP!)
850 800 (DOWN!)

WHY UP AND DOWN?

$\frac{400,000}{43,560}$ 9 ACRES.

THIS ANSWER WOULD BE OK FOR MANY PURPOSES.

EXACT ANSWER FOR 1:

475 X 850 =

$\frac{403,750}{43,560} = 9.27$

IN CHECKING THESE ANSWERS, REMEMBER THAT THE "ESTIMATES" MAY VARY WIDELY.

Calculate the value, to the owner, of standing timber. Take 10 acres at 12 cords per acre and $18.00 per cord "stumpage."

10 X 12 X $18 = $2,160.00

GIVE THE STUDENTS TIME TO WORK AND THEN ASK THEM TO PUT VARIOUS PARTS OF THE PROBLEM ON THE BOARD.

Calculate the value of the standing timber to the owner, in each of these problems:

1. A stand of 15 acres with 14 cords per acre and $18.00 stumpage.

   $3,780.00

2. A stand of 30 acres averaging 9 cords per acre and $12.50 stumpage.

   $3,375.00

3. A stand of $11\frac{1}{2}$ acres with 14 cords per acre and $21.50 stumpage.

   $2,225.25

GRUMP

$$\begin{array}{r} 34.95 \\ 2.78 \\ 16.4 \\ 3.75 \\ +\ 14.0 \\ \hline 71.88 \end{array} \qquad \begin{array}{r} 39.604 \\ -\ 12.937 \\ \hline 26.667 \end{array}$$

$$\begin{array}{r} 43.5 \\ \times\ \ .19 \\ \hline 8.265 \end{array}$$

$$\begin{array}{r} 5.383 \\ 3.62\overline{)\,19.487} \end{array}$$

(ROUNDED)

END CLASS HERE

8 & 9. How Much Can You Make?

Mike is beginning to get an idea of how wood is cut, measured, and sold. He knows how much it will bring in the pulpwood yard and now much the owner of the land gets. But how much, he wonders, can you earn by steady work as a pulpwood producer?

He looks at it this way: Take a weeks work in harvesting pulpwood, deduct expenses, and let's see what's left. That would be my profit if I were a pulpwood producer. Mike kept track of the deliveries Mr. Sams made to the pulpwood yard during one week:

day	loads	cords
Monday	2	3.4, 3.8
Tuesday	3	3.2, 3.6, 2.9
Wednesday	2	3.7, 4.1
Thursday	3	3.6, 2.9, 3.7

Go back and look at the pulpwood receipt on page 75. Use that form to figure out how much money Mr. Sams will make on each load. If 3 or 4 people get together in a group and these problems you will get done faster.

GO BACK WITH THE STUDENTS AND REVIEW HOW THIS WAS DONE.

IN GROUPS OF TWO TO FOUR STUDENTS SHARING ANSWERS. THIS SHOULD GO FAIRLY QUICKLY.

Cash after Deductions:

Monday	3.4	$42.50
	3.8	47.50
Tuesday	3.2	40.00
	3.6	45.00
	2.9	36.25
Wednesday	3.7	46.25
	4.1	51.25
Thursday	3.6	45.00
	2.9	36.25
	3.7	40.00
Week's Total		$430.00

Now we know how much Mr. Sams got when he sold the wood he had cut. What expenses are already paid for him?

STUMPAGE

TRUCK PAYMENT

SAW PAYMENT

THE EXPENSES WHICH ARE DEDUCTED ON HIS PULPWOOD RECEIPT: STUMPAGE, TRUCK AND SAW.

What other expenses does Mr. Sams have in doing business? Estimate how much each expense you think of will cost him.

MIKE $1.75 PER HOUR X 48 HRS. = $84.00

OTHER MAN $2.25 PER HOUR X 48 HRS. = $108.00

TRUCK MAINTAINENCE 200 MILES X 15 ¢/MILE = 30.00

GAS FOR SAWS 8.00: BUSINESS EXPENSES $20.00

TOTAL EXPENSES $250.00

MIKE EARNS $1.75 PER HOUR. A PULPWOOD CREW IS NORMALLY 3 MEN, THE PRODUCER AND 2 OTHERS SO THERE IS ANOTHER MAN WHO PROBABLY EARNS MORE THAN MIKE. GASOLINE FOR THE TRUCK AND SAWS. OTHERS THAT THE STUDENTS MAY MENTION: INSURANCE, AN ACCOUNTANT TO KEEP HIS BOOKS, ETC.

How much did Mr. Sams earn that week?
Could he make that much at a regular job?

GRUMP

35.2 + 47.9 + 296.83 + 46. + 0.39 = 426.32

29.61 x 3.4 = 100.674

304.7 - 197.34 = 107.36

43.79 ÷ 296.1 = .148
(ROUNDED)

END CLASS HERE

10. Growing Wood: Cords Per Acre

Mike knew how much the owner of the land got for stumpage: $18.00 per cord. But he did not know how much money a man could make from an acre of land planted in trees or how long it would take to grow them.

When he looked up this information he found that "wild land" will grow from 1/2 to 1 cord per acre per year, depending on soil, water, and climate. A plantation or tree farm which is planted and managed will grow from 1 to 2 cords per acre per year. Again, this will depend on soil, water and climate. A stand of pine will grow in 20 years, or sometimes less. After 20 years, how many cords of wood would you get from an acre of wild land?

Least expected: 10 CORDS/ACRE

Most expected: 20 CORDS/ACRE

GIVE THE STUDENTS TIME TO WORK ON THESE PROBLEMS

After 20 years, how many cords would you get from an acre of land in a planted and managed forest?

Least expected: 20 CORDS/ACRE

Most expected: 40 CORDS/ACRE

A farmer plants 20 acres in trees, which he expects to harvest in 20 years. At $18.00 per cord stumpage how much can he expect to get for his wood in 20 years?

Most expected: $144,000

Least expected: 72,000

YOU WILL NEED TO EXPLAIN THE RATE "PER ACRE PER YEAR".

How much did he make per acre per year for the time his land was used to grow the trees?

Most expected: $ 36.00

Least expected: $ 18.00

GRUMP

42% of 9,375 = 3,937.5

14 is 25 % of 56.

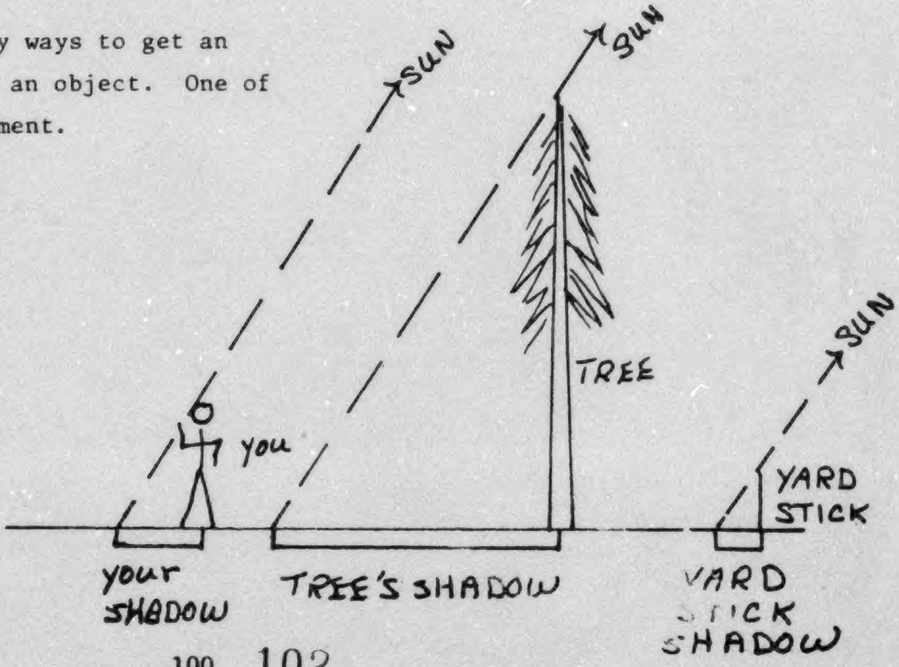
28% of a number is 14.
What is the number? 50

11. Finding Wood: Estimating the height of a tree

One of the things that Mr. Sams needs to do to keep his business going is to find land owners who have wood and want to sell it. He will then estimate how much wood a man has on his land and how long it will take to harvest it. What will tell you how much wood a man has on his land? What would you need to know to estimate?

WE WILL TAKE ONLY 2 FACTORS: NUMBER OF ACRES AND TREE HEIGHT DENSITY OF TREES AND MANAGEMENT WILL ALSO EFFECT THIS.

There are several easy ways to get an estimate of the height of an object. One of them is by shadow measurement.



Objects and their shadows at any particular time, form the same fraction so,

$$\frac{\text{Your Height}}{\text{Your Shadow}} = \frac{\text{Tree Height}}{\text{Tree Shadow}}$$

YOU MAY WANT TO AMPLIFY THIS BY REVIEWING SIMILAR TRIANGLES AND PROPORTIONAL SIDES.

or, if you have a yard stick,

$$\frac{\text{Yard Stick}}{\text{Yard Stick Shadow}} = \frac{\text{Tree Height}}{\text{Tree Shadow}}$$

Let's invent one for practice: you are 5'5" tall. You measure your shadow and find it is 3'4" long. You measure the shadow of a tree and find it is 28 feet long. How tall is the tree?

GIVE THE STUDENTS SOME TIME TO WORK - TELL THEM TO USE THE FORMULA. BUT IF THEY ARE NOT GETTING IT, SHOW THEM HOW TO DO IT IN STEPS LIKE THIS.

STEP 1: CHANGE YOUR HEIGHT AND YOUR SHADOW TO INCHES. 5'5" = 60 ", 3'4" = 40".

STEP 2: FILL IN FORMULA $\frac{60}{40} = \frac{?}{28}$

STEP 3: MULTIPLY. $\frac{60}{40} \times \frac{28}{1} = \underline{\quad ? \quad}$

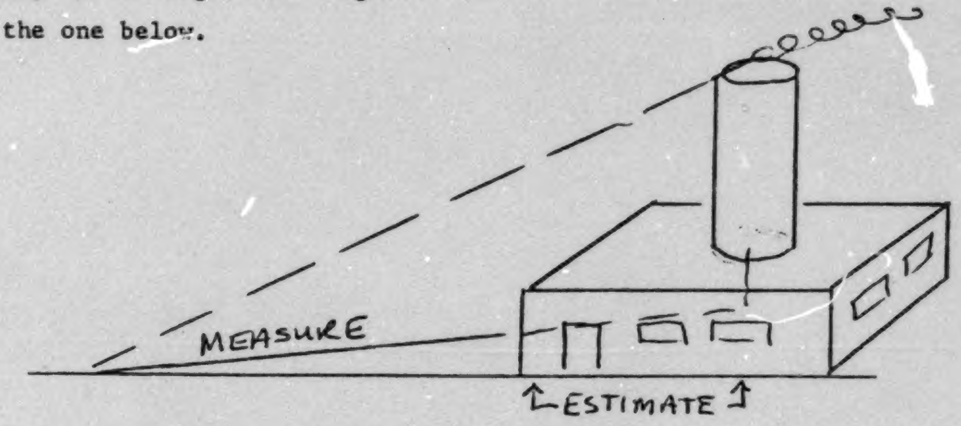
STEP 4: SOLVE $\frac{60 \times 28}{40} = 42$ FEET

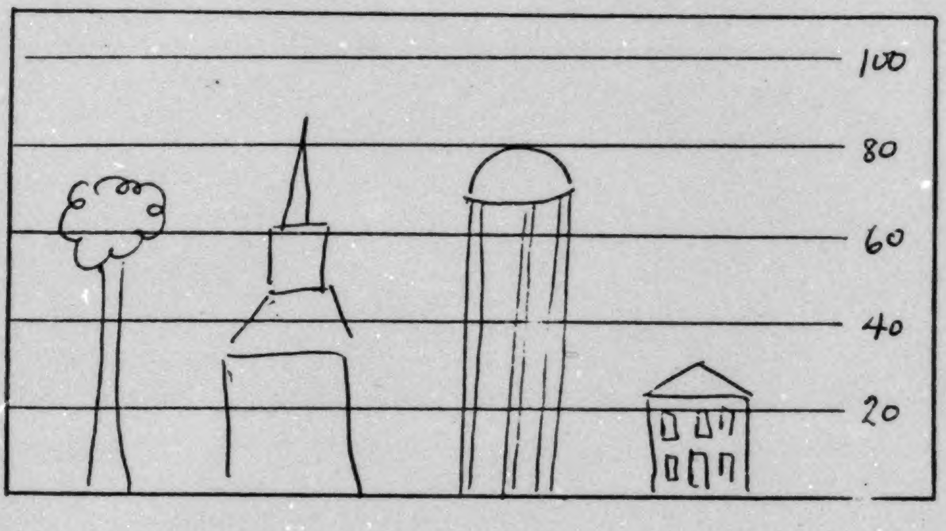
Solving the same kind of problem is easier and more accurate with a yard stick. Try this one: The shadow of the yard stick was 48 inches long at the time the shadow of the tree was 76 feet. How tall is the tree?

GIVE THE STUDENTS TIME TO WORK. IT IS WORKED THE SAME WAY THE LAST ONE WAS. THE "MISSING" INFORMATION IS THE LENGTH OF THE YARD STICK, 36 INCHES OF COURSE.

MISSION INCREDIBLE

Choose some prominent land marks around town and around your school. Church towers, trees, the school chimney, etc., would all be good. Measure their heights using shadow measurement. For a building you may have to estimate part of the shadow length. Make a bulletin board display showing these heights on a graph like the one below.





Work these problems:

1. My height: 5'10"
   My Shadow: 4'2"
   Tree's Shadow 47 feet.

   65.8 FEET TALL

2. My height: 5'2"
   My Shadow: 7'6"
   Tree's Shadow: 91 feet.

   62.7 FEET TALL

3. My height: 6'
   My Shadow: 4'4"
   Tree Shadow: 61 feet.

   84.5 FEET TALL

4. Yard Stick's Shadow: 30"
   Tree's Shadow: 42 feet.

   75.6 FEET

5. Yard Stick's Shadow: 39"
   Tree's Shadow: 21 feet.

   19.4

OF COURSE, THE YARD STICK IS ALWAYS 36 INCHES LONG.

12. Estimating Working Time

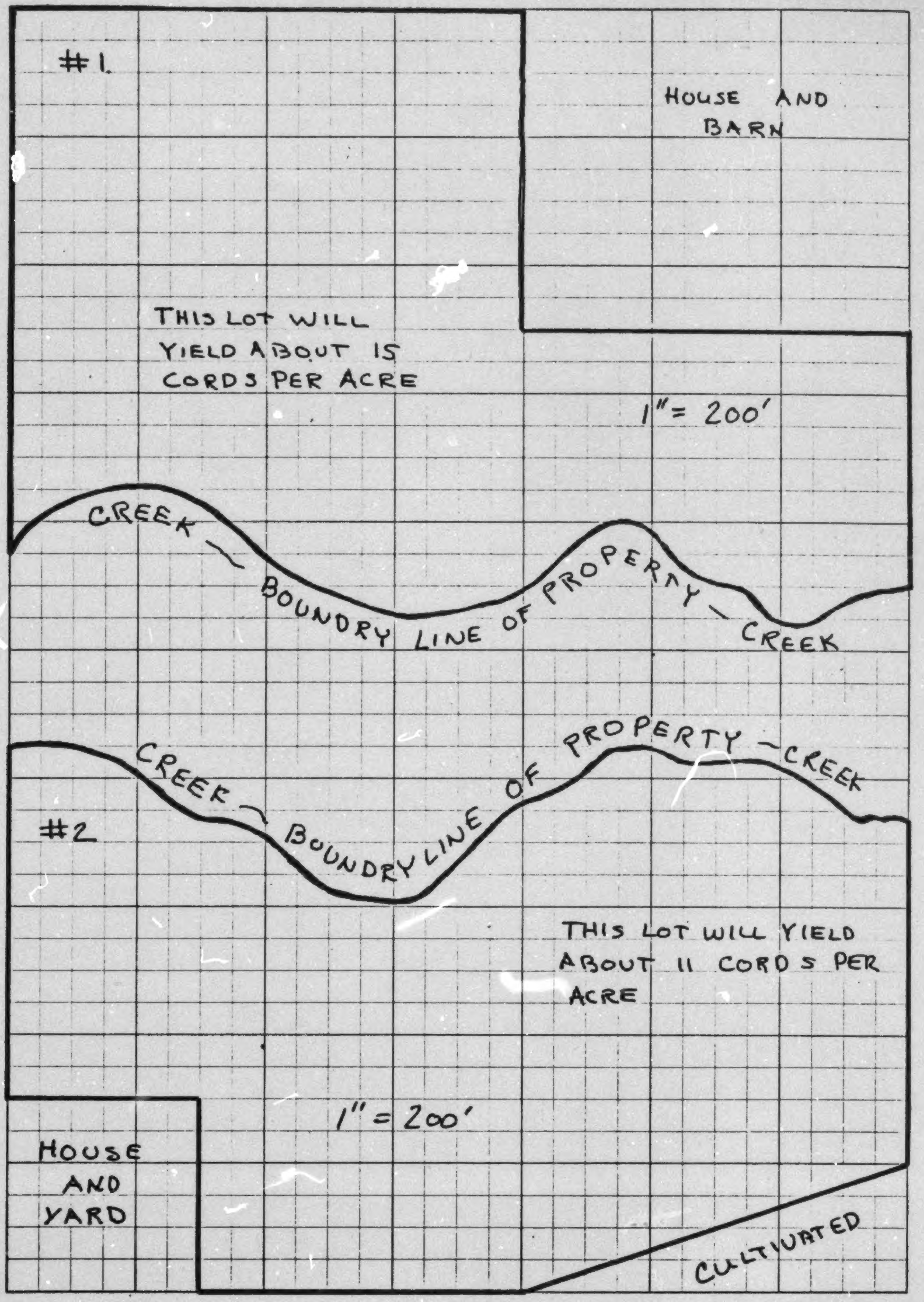
Mr. Sams has located a stand of trees which the owner wants to sell. This is a large irregular area shown on page 20. Mr. Sams inspects the property and estimates the height of the trees. After looking the property over he thinks that there are about 15 cords per acre on this land. "Mike," he asks, "about how many acres do you think there are in this area?" Mike said, "Well, I can't figure it very close because of that creek, but I can get a good estimate. Look at drawing #1 on page 20. Can you estimate the number of acres on this land? Try it now. Work in groups if you wish. The drawings on page   are drawn to scale 1 inch = 200 feet.

Now... how many acres do you think are in the first property? How many cords of wood will come out of that forest?

acres: 23 ACRES   cords: 345 CORDS

THERE ARE SEVERAL WAYS TO HANDLE IRREGULAR AREAS. THEY CONSIST OF CUTTING AN IRREGULAR AREA INTO KNOWN AREAS AND FINDING AREA BY FORMULA AND ESTIMATING THE AREA ADDED BY IRREGULAR PARTS FOR WHICH NO FORMULA IS KNOWN. LOOK AT YOUR PAGE TO SEE HOW THIS HAS BEEN DONE. DON'T GIVE HINTS TO THE STUDENTS TOO QUICKLY.. LET THEM THINK OF THIS BY THEMSELVES!

GIVE THE STUDENTS AMPLE TIME TO WORK ON THIS BEFORE GIVING ANY OF THE HINTS ABOVE.


#1.
HOUSE AND BARN
THIS LOT WILL YIELD ABOUT 15 CORDS PER ACRE
1" = 200'
CREEK – BOUNDRY LINE OF PROPERTY – CREEK
CREEK – BOUNDRYLINE OF PROPERTY – CREEK
#2
THIS LOT WILL YIELD ABOUT 11 CORDS PER ACRE
1" = 200'
HOUSE AND YARD
CULTIVATED

Look back to the information contained in lessons 8 and 9. How long will it take Mr. Sams and his crew to harvest the wood on this land? How much will the owner of the land get for his wood and how much will Mr. Sams earn? Get together in a group to work out the answers to these questions. Use a calculator is one is available.

THIS IS A LONG AND COMPLEX PROBLEM WITH MANY POSSIBLE WAYS TO WORK IT OUT. KEEP IN TOUCH WITH THE GROUPS OF STUDENTS AS THEY WORK OUT THE ANSWERS.

THE STUDENTS SHOULD ASSUME 35 CORDS PER WEEK IN THESE PROBLEMS.

IN THE WEEK DESCRIBED IN LESSON 8 AND 9, MR. SAMS CUT 35 CORDS. IT SHOULD TAKE ABOUT 10 WEEKS TO CUT 345 CORDS.

LAND OWNERS GETS $18.00 PER CORD STUMPAGE. THAT'S 6210.00.

MR. SAMS WILL GET $12.50 PER CORD LESS EXPENSES. HE WILL ACTUALLY EARN ABOUT $1,800.00 in 10 WEEKS.

(If you need more space, work on the backs of pages.)

13. A Chance to be "Self-Employed."

Mike now has an opportunity to become a pulpwood producer himself. He can harvest the wood in lot #2, pictured on the last page. It is not as good a stand of trees but should yield about 11 cords per acre. Should Mike do it? How long will it take him to get the wood out of that lot?

THIS WILL TAKE TIME. ESTIMATE THE AREA. CALCULATE CORDS ON LOT ESTIMATE CORDS/WEEK CALCULATE NUMBER OF WEEKS.

900,00 SQ. FT. = 20.66 ACRES
20.66 X LL CORDS/ACRE = 227 CORDS
6 WEEKS IF HE CAN WORK AS FAST AS MR. SAMS.
PROBABLY NOT - IT MAY TAKE HIM 8 WEEKS.

How much will he make if he pays two helpers each $1.75 per hour and works 48 hours per week?

THIS WILL TAKE TIME. CALCULATE DEDUCTIONS FOR STUMPAGE, SAW, TRUCK, AND PAY FOR WORKERS. ESTIMATE EXPENSES FOR GASOLINE.

227 CORDS X 33.00 =	$7,491.00
STUMPAGE (18.00)	4,086.00
	$3,405.00
TRUCK AND SAW (2.50)	567.50
	$2,837.50
2 HELPERS (1.75/HR, 48 HRS/WEEK, 8 WEEKS)	1,344.00 $1,493.00
EXPENSES (TRUCK MAINTAINENCE, GAS FOR SAWS, BUSINESS EXPENSE, $30. PER WEEK)	$ 240.00
	$1,253.50
PER WEEK	$ 156.69

14. Summary and Discussion

What do you think about the pulpwood business?

Would you do what Mike did, learn the business and buy a truck to get into it?

TEACHER'S MANUAL

LUMBER YARD EMPLOYEE

General Instructions

1. Use of outside speakers and field trips. Schools and teachers differ in the degree to which they can use speakers and take students from the school on field trips. For this reason the unit is "self contained." However, here are some suggestions for interesting activities which will contribute materially to the unit.

A. Call a lumber yard in your area and ask the manager if he would speak to the students about a job in the lumber yard.

B. Have the Industrial Arts teacher or the Agriculture teacher speak to the class regarding the use of lumber.

2. The "read it in class" feature. The students pages are presented as a connected narrative. Problems grow out of the narrative. This story is to be read in class and, as problems come up, the students stop and work these out. Each day normally will end with a problem set. There are also discussion questions within the story and these should be treated during class time as described in item 3 below. This "read it in class" procedure should beused to contribute to the students growth in reading skill, also.

The narrative is designed to bring up mathematical problems as they might arise on the job, to foster desirable attitudes toward employment, to present realistic employment information, and to give the students a focus for discussion of questions related to careers.

3. The "discussion question" feature. There are a number of questions for discussion. These are marked by an ※ on the dividing line. These questions point up ideas related to mathematics and careers. When you reach each such question spend some time getting students to think and tell their ideas and opinions.

4. The "Daily Problem" feature. Almost every day a verbal problem or "story problem" will be encountered in the material. This contact with verbal problems on a daily basis will help to overcome students fear and dislike of such problems. Time should be taken in class for (1) students to work independently on the problem and (2) for group discussion and presentation of various solutions.

5. The "It's a Rip Off" feature. Many students enjoy puzzles and problems of a mathematical nature. They may enjoy this aspect of mathematics more than the regular class work. A problem such as that is presented every two or three days, located at the bottom of the page so the student can "rip it off" and take it home. Class time should be spent on these

problems after students have worked on them, taking about one half hour for each such problem.

6. General Review of Underlying Mathematical Processes. (GRUMP). Grump's are short computational assignments given several times each week to prevent forgetting of computational skills.

7. Mission Incredible Assignments. When an assignment involves work outside the school or when only one or two students are needed to do an assignment, such as constructing a demonstration, the assignment is optional for extra credit. It is frequently important to have at least one student do each of these assignments because the information collected or the demonstration constructed will contribute to the class activities.

Materials Needed

Price list (one per student)

Lumber Measurement sheet (one per student)

Lumber Yard Employee

Frank Johnson

1. Discussion of Job

Frank has been hired to work in a lumber yard. His job requires him to wait on customers, fill orders, and make out the bills for the orders. On his first day on the job Frank found out there were a lot of things he didn't know about selling lumber. He found out that there were many different ways of pricing different products. For example, nails are sold by the pound. Can you think of any other ways that items in a lumber yard would be priced? Make a list in the space on the right of other ways you think items may be priced.

After you have completed your list, you will have a chance to discuss this in class.

When a product is priced it is usually stated like the following:

Common Nails...$.30 per pound

House paint....$5.95 per gallon

When pricing a product, the price is usually given for "one unit" like gallon, pound, foot. What would it cost a customer to purchase 5 gallons of paint at the above price? (Don't forget to add the tax)

MATERIALS: LUMBER YARD PRICE LIST (HAVE ONE FOR EACH STUDENT)

BEFORE YOU GIVE THE STUDENTS THE PRICE LIST DISCUSS THE VARIETY OF WAYS THAT THE PRODUCTS MAY BE PRICED. YOU WILL WANT TO LET THE STUDENTS SUGGEST OTHER "PRICING UNITS" EVEN IF THEY ARE NOT ASSOCIATED WITH THE LUMBER YARD. THIS WILL HELP BRING OUT THE IDEA OF PRICING.

DISCUSS THE IDEA OF PRICING PRODUCTS "PER UNIT". PREPARE A NUMBER OF EXAMPLES THAT WILL DEMONSTRATE THIS NOTION.

```
 $ 5.95      $29.75
    X 5         .89
 ------      ------
 $29.75      $30.64
    .03
 ------
  .8925
```

END CLASS HERE

---

2. Lumber Yard Price List

When Frank began work the manager gave him a price list to help him make out the sales slips for the customer. When Frank looked at the list he saw several words and terms that he didn't know. Are there any that you do not understand?

The manager told Frank he would not be expected to know all the new terms right away. He could learn them as he went along on his new job.

HAND OUT PRICE LIST TO THE STUDENTS. THERE WILL BE SOME TERMS THAT THEY WILL NOT KNOW. THIS WILL BE THE BASE FOR THE LESSONS THAT FOLLOW. DISCUSS THIS WITH THE STUDENTS AND LET THEM KNOW THEY WILL LEARN THESE NEW TERMS. TAKE THE TIME TO MAKE A LIST OF "TERMS OR WORDS" THE STUDENTS DON'T UNDERSTAND. DO NOT GO INTO THE EXPLANATION YET, THIS WILL BE COVERED IN FUTURE LESSONS.

What other jobs could he do in the lumber yard besides filling orders?

3. Making Out Sale Receipt

Frank was given the following order to fill.

BUILDER SUPPLY CO.

#	Description	Unit Cost	
6 lb.	Common Nails		
2 lb.	Finish nails		
9	3/4 x 4 x 8 Plywood		
	Total		
	Tax (3%)		
	Total		

Once Frank had loaded the order on the mans truck he had to figure out the cost of the order. (Use your price list to complete the sales receipt).

First, he found out that the common nails were how much per pound? ___a___ per pound.

How much would the six pound of nail cost? ___b___

The finish nails cost how much per pound? ___c___ Then the 2 pounds costs how much? ___d___

Finally, the plywood costs ___e___ per sheet and the 9 sheets would cost ______ in all.

What was the total cost of the building materials? ___f___. Frank then completed the receipt by figuring the 3% tax and adding it to the cost of the materials. What total should he have gotten?

Using the price list on the next page, find the cost of each of the following orders.

WORK THROUGH THIS PROBLEM WITH THE STUDENTS. SELECT SEVERAL OTHER EXAMPLES BEFORE HANDING OUT THE STUDENTS ASSIGNMENT.

A) 30¢ PER POUND
B) 6 X .30 = $18.0
C) .35 PER POUND
D) 2 X .35 = .70
E) $14.75
F) $14.75
X 9
$132.75
G) 135.95
H) TAX: 135.95
.03
4.0785
or $4.08
I) 135.95
+ 4.08
$140.03

THE STUDENT CAN NOW BE GIVEN TIME TO COMPLETE THE FOUR ORDER BLANKS.

END CLASS HERE

BUILDERS SUPPLY CO.

#	Description	Unit Cost	
4 lbs.	common nails		
12	1/4x4x8 AC plywood		
	Total		
	Tax (3%)		
	Total		

BUILDERS SUPPLY CO.

#	Description	Unit Cost	
5 gal.	White paint		
4 lbs.	Finish Nail		
15	3/4x4x8 AD plywood		
	Total		
	Tax (3%)		
	Total		

BUILDERS SUPPLY CO.

#	Description	Unit Cost	
4	3/4x4x8 AC plywood		
8	1/4x4x8 AC plywood		
3 lbs.	Box nails		
	Total		
	Tax (3%)		
	Total		

BUILDERS SUPPLY CO.

#	Description	Unit Cost	
14	3/4x4x8 AD plywood		
	Total		
	Tax (3%)		
	Total		

4. Linear Feet

Frank was loading the truck for a delivery one day when he saw an item he didn't understand. The order asked for "100 linear feet of 2x4's." Frank decided that he better ask his boss before he loaded the wrong thing. Mr. Wood gave him the following examples to look at. Can you tell what "linear feet" means?

a) a 2 x 4 x 12 feet has 12 linear feet
b) a 2 x 4 x 24 feet has 24 linear feet
c) a 2 x 4 x 14 feet has 14 linear feet

Frank looked at the examples and said, "You mean linear feet is just the same as the regular length of the board?" Mr. Wood said that's right, can you tell me how many linear feet there are in 3 - 2 x 4 x 12 feet? Frank said there must be 36 linear feet all together. Was Frank right?

Mr. Wood told Frank that the lumber only came in special lengths. The boards would be 8 feet, 10 feet, 12 feet, 14 feet, 16 feet, 18 feet, 20 feet, 22 feet and 24 feet in length. He also said they sometimes were longer but he didn't keep them in stock. What length do you think the next board would be?

Frank went back to load the truck and put the following 2 x 4's on the truck.

5 - 2 x 4 x 8 feet
5 - 2 x 4 x 12 feet

Did he have 100 linear feet of 2 x 4's on the truck?

HAVE THE STUDENTS READ THIS SECTION TO THEMSELVES OR SELECT A STUDENT TO READ IT ALOUD.

BEFORE GOING BEYOND THIS POINT MAKE SURE EVERYONE SEES WHAT THE TERM "LINEAR FEET" MEANS.

12 LINEAR FEET PER BOARD
X 3 BOARDS
36 LINEAR FEET TOTAL

YES

LENGTHS OF BOARD USUALLY START AT 8 FEET AND INCREASE BY 2 FEET EACH TIME. OR WE COULD SAY THAT THE LENGTH OF A BOARD WILL BE A "MULTIPLE OF 2 AND 8 FEET OR LONGER IN LENGTH." THUS, THE NEXT LENGTH AFTER 24 FEET WOULD BE 26 FEET AND THEN 28 FEET. NORMALLY THEY WOULDN'T GO MUCH BEYOND THIS LENGTH.

ALSO, IN THIS DISCUSSION YOU CAN BRING IN THE FACT THAT THE BOARDS ARE IN EVEN LENGTHS.

YOU CAN WORK THIS PROBLEM AS FOLLOWS:

8 LINEAR FEET
X 5 BOARDS
40 LINEAR FEET

12 LINEAR FEET
X 5 BOARDS
60 LINEAR FEET

40 LINEAR FEET
+60 LINEAR FEET
100 LINEAR FEET

Is there any other way Frank could have gotten 100 linear feet of 2 x 4's on the load?

* YES, SOME EXAMPLES FOLLOW.
* THERE ARE, OF COURSE, MANY OTHER WAYS TO DO THIS. HAVE THE STUDENTS GIVE AS MANY AS THEY CAN AND EXPLAIN WHY THEY ARE RIGHT.

A
2 - 2 X 4 X 20 FEET
2 - 2 X 4 X 10 FEET
5 - 2 X 4 X 8 FEET

B
5 - 2 X 4 X 16 FEET
1 - 2 X 4 X 20 FEET

C
5 - 2 X 4 X 20 FEET

Frank filled the following orders, find out how many linear feet of lumber went out in each order.

a) 8 - 2 x 4 x 12 feet
7 - 2 x 4 x 16 feet
12 - 2 x 4 x 10 feet

b) 20 - 1 x 4 x 16 feet
30 - 1 x 4 x 8 feet

c) 25 - 1 x 12 x 14 feet

d) 20 - 1 x 12 x 14 feet
8 - 1 x 12 x 16 feet

HAND OUT THE PROBLEMS ON THE LEFT AND GIVE THE STUDENTS TIME TO COMPLETE THEM IN CLASS.

END CLASS HERE

---

5. Board Feet (For 1 inch lumber)

After sending out an order one day, Mr. Wood

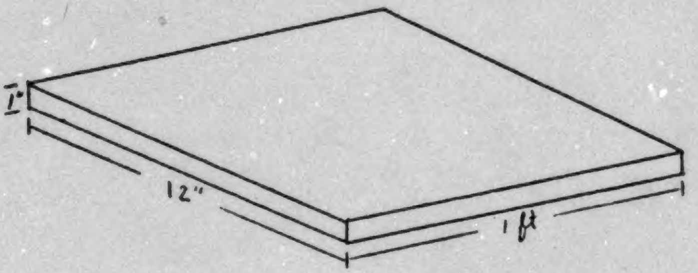
* IN THIS SECTION, IF AT ALL POSSIBLE, IT WOULD BE GREAT TO HAVE SOME BOARD AVAILABLE TO USE AS MODELS. THE

called Frank into his office. He told Frank there had been a mistake in filling the order. The order called for 50 board feet of 2 x 6's and there was only half enough sent. Frank said he had put 50 linear feet of 2 x 6's on the truck, wasn't that the same thing. He was told there was a difference between board feet and linear feet. Mr. Wood said he would explain the differences to Frank.

Let's start at the beginning. One board foot means we have a piece of wood 1 inch thick x 12 inches wide and 1 foot long. Here's a picture of what one board foot of lumber would look like.

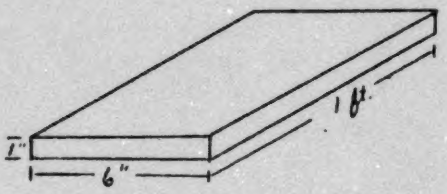
FOLLOWING IS A LIST THAT COULD BE USED

1 X 12" X 1 FT.
1 X 6" X 2 FT.
1 X 4" X 3 FT.
1 X 6" X 4 FT.
1 X 4" X 6 FT.



How many board feet would there be in a board 1" x 12" x 7 feet? Frank said, isn't this the same as the linear feet? Mr. Wood said it was in this case, but he would give another example. Let's look at a board 1" x 6" x 12".

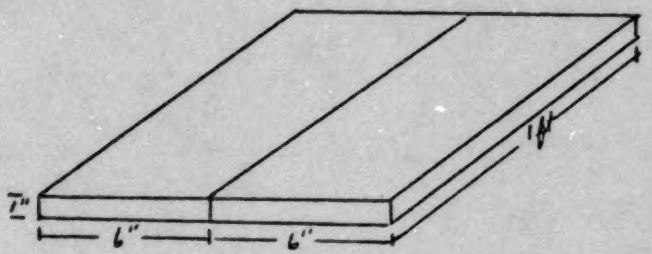
*7 BOARD FEET IS THE CORRECT
*ANSWER.



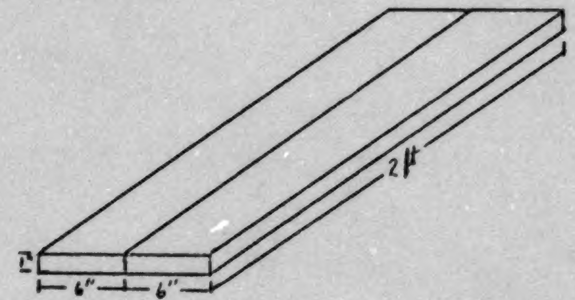
This board is 1 linear foot long but it is not one board foot. Why?

Let's see if we can put together pieces of 1 x 6 so it will make a board foot. Can you think of how this could be done. Discuss your idea's in class before going on.

Did anyone try to do it like the picture below



If you take 2 - 1 x 6 x 12" and put them together, they will make a board 1" x 12" x 12". Is this 1 board foot? Frank said he thoughthe had the idea for 1 x 6's. How about if I take a 1" x 6" x 4 ft. (he made a drawing) and put it together like this.



Wouldn't this give me 2 board feet of lumber? Mr. Wood told him that was correct. Frank said all he did was to think of cutting the board into two equal parts and putting them together.

Problems: Find the number of board feet in each of the following:

* REFER TO THE DRAWING OF "ONE BOARD FOOT." WE HAVE THREE DIMENSIONS TO WORRY ABOUT. IT MUST BE 1" X 12" X 12". A 1 X 6 X 12 DOES NOT SATISFY THIS BECAUSE IT'S ONLY 6" WIDE AND IT NEEDS TO BE 12."

* YES. EXPLAIN TO THE STUDENTS THAT THIS IS LIKE TAKING A BOARD TWO FEET LONG AND CUTTING IT INTO TWO 1 FOOT PIECES AND PLACING THEM SIDE BY SIDE.

DISCUSS AND USE MORE EXAMPLES IF NECESSARY. THEN GIVE STUDENTS TIME TO WORK THE PROBLEMS.

ASK THE STUDENTS IF THEY HAVE ANY OTHER IDEAS ON HOW TO FIGURE THE BOARD FEET IN A 1" X 6" BOARD.

	No. of Board	Size	Board feet
1.	2	1"x12"x10 feet	______
2.	1	1"x6"x14 feet	______
3.	5	1"x6"x14 feet	______
4.	1	1 x6 x20feet	______
5.	1	1 x6 x8 feet	______

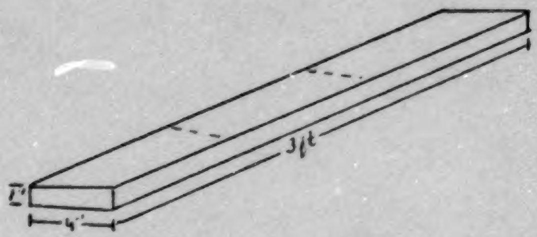
* AFTER THE STUDENTS HAVE COMPLETED THE PROBLEMS DISCUSS THE SOLUTIONS AND CORRECT ANSWERS.

THE STUDENTS SHOULD COME UP WITH THE FOLLOWING GENERALIZATION. "IF I AM TRYING TO FIND THE BOARD FEET IN A 1" X 6" BOARD. ALL I NEED TO DO IS DIVIDE THE NUMBER OF FEET IN THE LENGTH BY 2". EXAMPLE: A 1" X 6" X 18 FEET WOULD BE 18 ÷ 2 = 9 BOARD FEET.

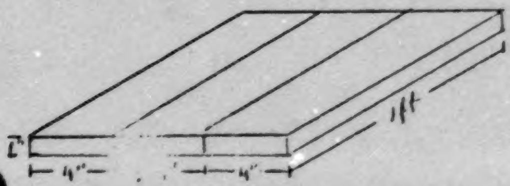
END CLASS HERE

6. Board Feet (For 1 inch lumber con't)

Frank decided that if he could figure board feet for 1" x 12" and 1" x 6" boards he should be able to do the same thing for 1" x 4" boards. He figured it like this.



If I take a board 1" x 4" x 3 feet, I can cut it into 3 pieces, 1 foot long and put them together to make 1 board foot (1" x 12" x 1 foot). He tried



*DISCUSS THIS METHOD WITH THE STUDENTS AND PROVIDE DRAWINGS OF OTHER EXAMPLES. IF POSSIBLE, SEVERAL BOARDS FROM THE WOOD SHOP COULD BE USED HERE TO DEMONSTRATE. IF NOT AVAILABLE USE CARDBOARD MODELS this same method for a board 1" x 4" x 6 feet. How many board feet did he find?

* AFTER THE STUDENTS WORK THE PROBLEM GIVE THEM THE ANSWER. 2 BOARD FEET.

Problems: Find the board feet in each of the following.

	No. of Boards		Board feet
1.	1	1"x12"x12 feet	________
2.	1	1 x 6 x 12 feet	________
3.	1	1 x 4 x 12 feet	________
4.	2.	1"x12"x18 feet	________
5.	2	1"x6"x18 feet	________
6.	2	1"x4"x18 feet	________

* GIVE THE STUDENTS AMPLE TIME TO WORK THE PROBLEMS IN CLASS. ENCOURAGE THEM TO USE DRAWINGS IF NECESSARY. AFTER THE STUDENTS HAVE COMPLETED THE PROBLEMS CORRECT THEM IN CLASS AND DISCUSS THEIR METHOD OF SOLUTION.

Frank looked at some problems he had worked (see following list) and decided there was an easier way to find the number of board, without making a drawing.

Size	Board feet
1" x 12" x 6 feet	6 board feet
1" x 12" x 18 feet	18 board feet
1" x 6" x 6 feet	3 board feet
1" x 6" x 16 feet	8 board feet
1" x 4" x 6 feet	2 board feet
1" x 4" x 9 feet	3 board feet

What do you think Frank had come up with?

* GET SOME SUGGESTIONS FROM THE STUDENTS AND TRY THEM OUT. EVENTUALLY YOU CAN EXPLAIN THE FOLLOWING:
A) SINCE 2 X 6 = 12 FOR A 1 X 6, I DIVIDE BY 2 TO FIND THE NUMBER OF BOARD FEET.
B) SINCE, 3 X 4 = 12 FOR A 1" X 4", I DIVIDE BY 3 TO FIND THE NUMBER OF BOARD FEET.

Problem: Find the number of board feet in each of the following.

	No. of boards	Size	Board feet
1.	2	1 x 4 x 6 feet	________
2.	10	1 x 6 x 12 feet	________
3.	1	1 x 2 x 2 feet	________
4.	18	1 x 12 x 8 feet	________
5.	4	1 x 2 x 10 feet	________
6.	4-4	1 x 6 x 8 feet	________

ASK THE STUDENTS WHAT THEY THINK THEY WOULD DO FOR 1" X 2" BOARD. (DIVIDE BY 6 TO FIND THE BOARD FEET.)

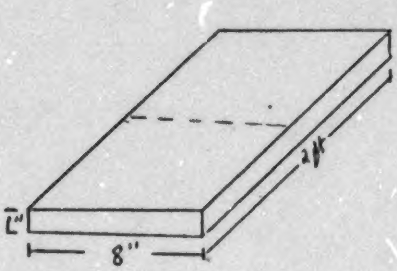
GIVE THE STUDENTS THE PROBLEMS ON BOARD FEET.

END CLASS HERE

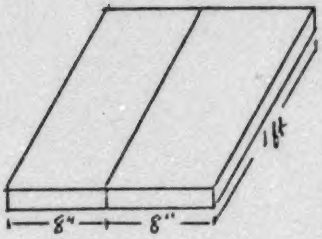
7. Board Feet (For 1 inch lumber cont'd)

Frank figures since he could find the board feet for 1 x 2's, 1 x 4's, 1 x 6's and 1 x 12's, he should be able to do the same for 1 x 8's. He decided to work just like he did for the other widths. "I'll just imagine * cutting the board and make a piece 1" x 12" x 1 foot and see what happens." The following drawings shows how he did his work.

AT THIS POINT IT IS STRONGLY RECOMMENDED THAT YOU USE A REAL MODEL OR AT LEAST A CARDBOARD MODEL OF THE PROCESS FRANK IS GOING THROUGH.



Frank started with a board 1" x 8" x 2 feet and cut it into 1 foot lengths.



This gave him a piece 1" x 16" x 1 foot.

Step 3. Frank figures that if he could get a piece 1" x 12" x 1 foot (1 board foot) he would try for 2 board feet. So he took 1" x 8" x 3 feet and cut it like the following drawing and then put them together

---

It's A Rip Off

(1) Write down a three digit number where the hundreds digit is larger than the ones digit. Example 842

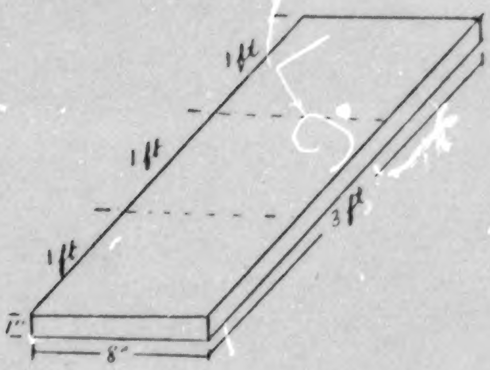
(2) Reverse the digits and subtract

$$\begin{array}{r} 842 \\ -\ 248 \\ \hline 594 \end{array}$$

(3) Reverse the digits and add

$$\begin{array}{r} 594 \\ +\ 495 \\ \hline 1{,}089 \end{array}$$

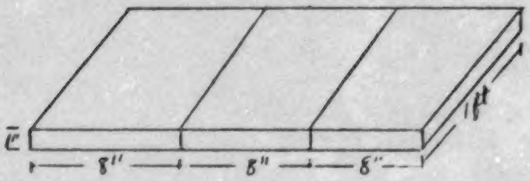
(4) What did you get?



USE A MODEL HERE ALSO.

like the drawing below.

Step 4.



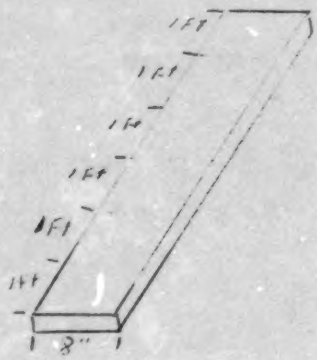
Frank thought, "I've got a board 1" x 12" x 2 feet, that's the same as 2 board feet. It takes a 1" x 8" x 3 feet to make 2 board feet." What do you think Frank tried next?

Frank decided there must be some sort of patterns for 1 x 8's. He didn't want to have to keep putting pieces of board together to work out board feet for a 1 x 8. He kept the following table to see if he could find the pattern.

LET STUDENTS MAKE SOME GUESSES AND THEN SUGGEST A BOARD 6 FEET LONG IF THEY DON'T COME UP WITH THIS FIGURE. ONCE THE FIGURE OF 6 FEET IS ARRIVED AT, ILLUSTRATE WITH A MODEL AFTER THE STUDENTS HAVE MADE SOME GUESSES.

Size	Board Feet
1 x 8 x 3	2
1 x 8 x 6	4
1 x 8 x 9	6
1 x 8 x 12	8

A)



(cont'd)

Size	Board Feet
1 x 8 x 15	_____
1 x 8 x 18	_____
1 x 8 x 21	_____

Can you finish the table and find the pattern?

Remember: for 1 x 2's you took 1/2 x length
1 x 4's you took 1/3 x length
1 x 6's you took 1/2 x length

Maybe there's a fraction you can multiply times the length for 1 x 8's.

Problems:

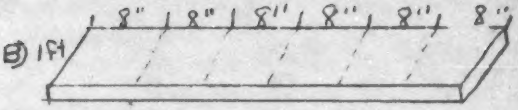
Find the number of board feet in each of the following:

	No. of Boards	Size	Board Feet
1.	4	1 x 6 x 12	_______
2.	2	1 x 8 x 12	_______
3.	2	1 x 3 x 14	_______
4.	9	1 x 4 x 12	_______

It's a Grump

4.75	37.52	15.65
x 23	x 36	x 7.46
.75	88	36
x .5	x .9	x .17

B)



C) THIS IS THE SAME AS A 1' X 12" X 4' LONG OR 4 BOARD FT.

D) AFTER THIS DEMONSTRATION LET THE STUDENTS CONTINUE WITH THEIR READING AND DISCUSS THE PROBLEM WITH THEM.

NOTE:

TRY TO GET THE STUDENTS TO SEE THE FOLLOWING:

1 X 2'S $\frac{1}{6}$ X LENGTH $\frac{2}{12} = \frac{1}{6}$

1 X 4'S $\frac{1}{3}$ X LENGTH $\frac{4}{12} = \frac{1}{3}$

1 X 6'S $\frac{1}{2}$ X LENGTH $\frac{6}{12} = \frac{1}{2}$

THUS:

1 X 8'S $\frac{8}{12}$ X LENGTH OR

$\frac{2}{3}$ X LENGTH.

ONCE THIS HAS BEEN DISCOVERED SEE IF THEY COULD PREDICT WHAT FRACTION WOULD BE USED FOR
1 X 3'S OR 1 X 9'S.

NOW ASSIGN PROBLEM SET
END CLASS HERE

8. Pricing lumber by the board foot

Mr. Wood asked Frank to complete the inventory sheet on the following page. Mr. Wood needed to know how many dollars worth of lumber he had in stock. He told Frank that he had completed the count of the lumber but did not have it priced yet. This was to be Frank's job.

Complete the inventory sheet by finding the number of board feet and the total cost.

Use your price list to find the correct price for the lumber. Remember you're using board feet. You'll find an example worked on the top of the next page.

THIS EXERCISE IS TO BE PRESENTED TO THE CLASS AT THE BEGINNING OF THE PERIOD (AFTER DRILL EXERCISES) AND THE STUDENTS SHOULD BE GIVEN THE TIME TO COMPLETE THE PROBLEMS DURING CLASS TIME. THIS WILL GIVE YOU AN OPPORTUNITY TO HELP THE STUDENT AND FIND OUT IF THERE ARE ANY PROBLEMS ARISING FROM THE BOARD FEET CONCEPT.

END CLASS HERE

Problem Set:

Example: 12 - 1" x 8" x 18 feet (common pine)

Step 1: Board feet in one 1 x 8 x 18 is

$$\frac{2}{3} \times \frac{18}{1} = \frac{36}{3} = 12 \text{ board feet}$$

Step 2: Since there are 12 boards the total board feet is

$$\begin{array}{r} 12 \\ \underline{\times\ 12} \\ 24 \\ \underline{12} \\ 144 \end{array} \text{ board feet}$$

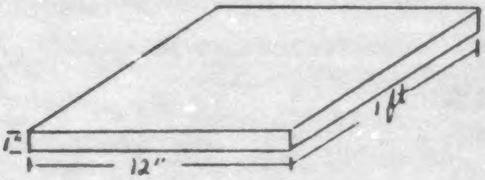
Step 3: The price of 1 x 8 common is $.48 a board foot. So the total cost is

$$\begin{array}{r} 144 \\ \underline{\times\ .48} \\ 1152 \\ \underline{576} \\ \$69.12 \end{array}$$

No. of Boards	Size of Board	No. of Board ft.	Price per Board foot	Total Cost
12	1"x8"x18'(common pine)	144	48	$ 69.12
15	1"x6"x12'(common pine)			
50	1"x12"x10'(common pine)			
25	1"x4"x20'(common pine)			
20	1"x8"x12'(common pine)			
14	1"x10"x12'(common pine)			

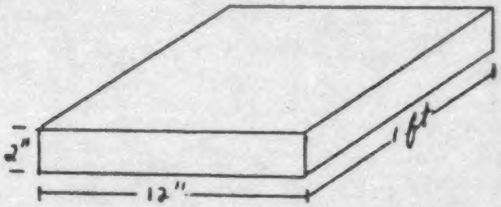
9. Board Feet (For 2 inch lumber)

A board foot has been defined to be a board 1" x 12" x 1 foot.

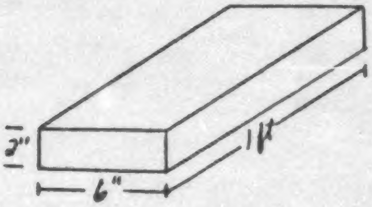


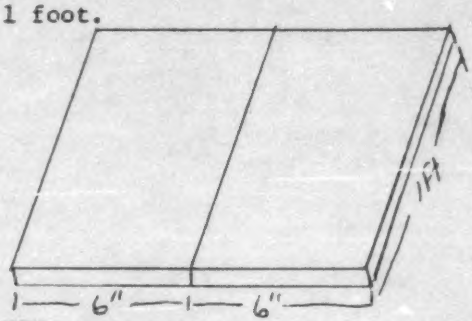
How many board feet would there be in a board 2" x 12" x 1 foot? Would it be the same as a 1 inch board?

DISCUSS THIS PROBLEM WITH THE STUDENTS AND USE A DEVELOPMENT SIMILAR TO THAT USED FOR 1 INCH LUMBER. SINCE THE BOARD IS 2" THICK WE COULD MAKE 2 BOARD 1" X 12" X 1 FOOT OR 2 BOARD FEET.



Discuss your solution with the class. Now try to find how many board feet there are in a board 2" x 6" x 1 foot.





Look at the table on the following page and see if you can discover a way of finding the board feet in a 2" board.

Now, that you have studied the table complete the last four entries in each column. Can you explain how to find the board feet for a 2 inch board?

HAVE THE STUDENTS STUDY THE TABLE AND DRAW THEIR ATTENTION TO THE PAIRINGS OF 1 INCH BOARDS AND 2 INCH BOARDS

EXAMPLE:
1"X12"X8' ⟶ 2"X12"X8'
1"X6"X10' ⟶ 2"X6"X10'

AFTER AMPLE TIME YOU SHOULD BE ABLE TO LEAD THEM TO THE FOLLOWING: IF YOU WANT TO FIND THE BOARD FEET IN A 2 INCH BOARD, YOU JUST

Size	Board Feet	Size	Board Feet
1" x 12" x 8 feet	8	2" x 12" x 8 feet	16
1[illegible] 12" x 16 feet	16	2" x 12" x 16 feet	32
1" x 6" x 10 feet	5	2" x 6" x 10 feet	10
1" x 6" x 18 feet	9	2" x 6" x 18 feet	18
1" x 4" x 12 feet	4	2" x 4" x 12 feet	8
1" x 4" x 18 feet	6	2" x 4" x 18 feet	12
1" x 8" x 12 feet	8	2" x 8" x 12 feet	16
1" x 8" x 24 feet	16	2" x 8" x 24 feet	32
1" x 6" x 14 feet	____	2" x 6" x 14 feet	____
1" x 12" x 8 feet	____	2" x 12" x 8 feet	____
1" x 8" x 6 feet	____	2" x 8" x 6 feet	____
1" x 4 x 15 feet	____	2 x 4 x 15 feet	____

Problem:

Don't get fooled in working the following problems. Some are 1 inch boards and some are 2 inch boards. Find the number of board feet in each of the following:

	No. of Boards	Size	Board Feet
1.	2	1" x 6" x 12 ft.	________
2.	4	2" x 6" x 12 ft.	________
3.	8	2" x 12" x 16 ft.	________
4.	1	2" x 8" x 12 ft.	________
5.	15	2" x 4 x 12 ft.	________

It's A Grump

$$\begin{array}{r} 487 \\ 982 \\ 17 \\ +\ 624 \\ \hline \end{array}$$

$37\overline{)4{,}672}$

$12\frac{1}{2} \times \frac{2}{3}$

$$\begin{array}{r} 4\frac{1}{2} \\ -\ 2\frac{1}{4} \\ \hline \end{array}$$

FIND WHAT IT WOULD BE FOR A 1 INCH BOARD OF THE SAME WIDTH AND LENGTH AND THEN DOUBLE YOUR ANSWER.

EXAMPLE:

FIND THE BOARD FEET IN A 2" X 6" X 12.

1) 1"X6"X12 FEET BOARD HAS 1/2 X 12 = 6 BOARD FEET.

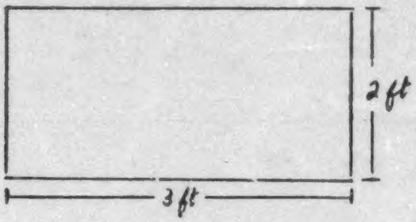
2) 2"X6"X12 FEET BOARD HAS 2 X 6 = 12 BOARD FEET.

YOU MAY WISH TO PROVIDE THE STUDENTS WITH A FEW MORE EXAMPLES BEFORE ASSIGNING THE PROBLEMS ON THE LEFT.

END CLASS HERE

10. Selling cut lumber.

Frank found out it was possible for a customer to get lumber cut to size. This caused some problems when it came to finding out how much to charge for the materials. For example, one day Frank sold a piece of 3/4 inch AC plywood that was 2 feet by 3 feet.



How do you think Frank could find out what it should cost?

Stop --- Let's see if the class can come up with the answer.

*THIS TURNS OUT TO BE THREE PROBLEMS. FIRST THE STUDENTS NEED TO FIND THE COST PER SQUARE FOOT, HOW MANY SQUARE FEET THERE ARE IN THE PLYWOOD BEING SOLD AND THIRD WHAT IT WOULD COST. THESE THREE PARTS SHOULD BE ARRIVED AT BY CLASS DISCUSSION. ONCE THIS HAS BEEN DONE GO THROUGH THE SOLUTION OF THE STATED PROBLEM.

A) THE SHEET OF PLYWOOD IS 4 FEET BY 8 FEET OR 32 SQUARE FEET. SINCE IT COST $14.75 PER SHEET (FOUND ON THE PRICE LIST) THE COST PER SQUARE FOOT IS

```
      .460 PER SQUARE FOOD (ROUND OFF TO $.46)
32/14.750
    128
     195
     192
       30
```

B) THE PIECE OF PLYWOOD TO BE SOLD IS 2 FEET BY 3 FEET OR 6 SQUARE FEET. (MAY NEED TO REVIEW AREA OF A RECTANGLE.)

C) THUS, THE COST OF THE ORDER IS

```
$  .46 PER SQUARE FOOT
  X  6 SQUARE FEET
$ 2.76
```

IN EACH OF THESE STEPS TRY TO GET THE CLASS TO MAKE SUGGESTIONS AS WHAT TO DO BEFORE GOING ON.

A customer came into the lumber yard and wanted an estimate of what it would cost for the lumber to build a dog house. He gave Frank the following list of materials. Using your price list and what you have learned find the cost of the materials needed for the project.

MATERIALS LIST FOR DOG HOUSE

2 pieces 1/2" x 2 ft. x 3 ft. AC plywood
2 pieces 1/2 x 2 ft. x 2 ft. AC plywood
2 pieces 1/2 x 1 1/2 ft. x 3 ft. AC plywood
1 piece 3/4 x 2 ft. x 3 ft. AC plywood
2 lbs. Box nails
2 qts. White paint

AFTER COMPLETING THIS, DO SEVERAL MORE EXAMPLES. EMPHASIZE THE THREE BASIC STEPS. ONCE YOU HAVE COMPLETED THESE EXAMPLES HAVE THE STUDENTS FIND THE COST OF BUILDING THE DOG HOUSE ILLUSTRATED AT THE LEFT.

1/2 INCH AC PLYWOOD COST $13.75 PER SHEET OR $13.75 ÷ 32 = $.43 PER SQUARE FOOT.

2/2'X3' = 12 SQUARE FOOT
2/2'X2' = 8 SQUARE FOOT
2/1 1/2'X3=9 SQUARE FOOT
29 SQUARE FOOT OF 1/2" PLYWOOD

29 X $.43 = $12.47 FOR THE 1/2" PLYWOOD

THERE IS A TOTAL OF 6 SQUARE FOOT OF 3/4" PLYWOOD AT $.46 PER SQUARE FOOT OR 6 X $.46 = $1.76.

THE 2 LBS. BOX OF NAILS COST 2 X $.35 = $.70.

THE PAINT COST 2 X $1.25 = $2.50.

THE TOTAL PROJECT COST IS AS FOLLOWS:

1/2 PLYWOOD	$12.57
3/4 PLYWOOD	$ 2.76
NAILS	.70
PAINT	2.50
Total Cost	$18.43

IF THERE IS NOT TIME TO COMPLETE THIS PROBLEM IN ONE CLASS PERIOD YOU MAY WISH TO COMPLETE IT THE FOLLOWING DAY.

END CLASS HERE

11. Keeping a running inventory.

Another responsibility that Frank was given was keeping a "running" inventory. This means that he must keep track of the lumber that is in stock. Frank was told he should check the inventory once every two weeks. Why do you think it would be important to make this kind of check?

The first time Frank took the inventory he counted all the lumber. However, he found this took too long. He thought maybe he could come up with a way to save himself some work.

Can you come up with a way that Frank could save time in taking his inventory?

Frank desides he could just measure the stack of lumber and then figure out how many pieces there was in the stack. Here's a situation Frank worked out. A stack of plywood was 30 inches high and each piece was 1/2 inch thick. So Frank said he would work it as follows.

$$30 \div \frac{1}{2} = \frac{30}{1} \times \frac{2}{1} = 60$$

This told Frank there were 60 pieces of 1/2" plywood in the stack. Why?

Problem:

Frank measured another stack of plywood and found it was 60 inches high. If each piece was 3/4 inch thick, how many pieces were there in the stack?

There was one thing that caused Frank some problems. He found that lumber wasn't always measured by what he thought it should. For example, a 1" x 4" board was really 3/4" x 3 1/2", a 1" x 6" board was really 3/4" x 5 1/2", and a 2" x 4" was really 1 1/2" x 3 1/2". What do you think the measurements of a 2" x 6" board would be?

Using the list given to you, solve the following:

Problem:

1. How many 2 x 4 are there in a stack 60 inches high?

2. How many pieces of 1/4" plywood are there in a stack

HAVE THE STUDENTS GIVE THEIR IDEAS ON THE SUBJECT. TRY TO BRING OUT THE NEEDS TO INVENTORY SUCH AS; REORDERING MATERIALS, FINDING OUT WHAT KIND OF MATERIALS SELL FAST, MAKING SURE THERE IS ENOUGH LUMBER TO COVER LARGE ORDERS, ETC.

BEFORE GOING ON TO THE EXPLANATION THAT FOLLOWS SEE IF THE STUDENTS CAN COME UP WITH SOME GOOD WAYS.

DISCUSS THIS PROBLEM WITH THE STUDENTS. MAKE SURE THEY UNDERSTAND WHY YOU MUST DIVIDE. ONCE YOU HAVE DONE THIS LET THEM TRY THE SAMPLE PROBLEM.

$60 \div \frac{3}{4} = \frac{60}{1} \text{ X } \frac{4}{3} = \frac{240}{3} =$

80 PIECES.

1 1/2" X 5 1/2" MEASUREMENT. HAND OUT THE SHEET THAT CONTAINS SOME OF THE ACTUAL MEASUREMENTS OF BOARDS. USING THIS LIST WORK THE FIRST PROBLEM OF THE PROBLEM SECION AS EXAMPLES. THEN ALLOW THE STUDENTS TIME TO WORK IN CLASS.

END CLASS HERE

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48 inches high?

3. How many 2 x 6 are there in 4 stacks, if each stack is 24 inches high?

4. How many 1 x 8 are there in 12 stacks, if each stacks, if each stack is 72 inches high?

5. How many pieces of 5/8" plywood are there in a stack 45 inches high?

NOTES: ANSWERS

1) $60 \div \frac{3}{2} = \frac{60}{1} \times \frac{2}{3} = 40$

2) $48 \div \frac{1}{4} = \frac{48}{1} \times \frac{4}{1} = 192$

3) $24 \div \frac{3}{2} = \frac{24}{1} \times \frac{2}{3} = 16$

16 X 4 STACKS = 64

4) $72 \div \frac{3}{4} = \frac{72}{1} \times \frac{4}{3} = 96$

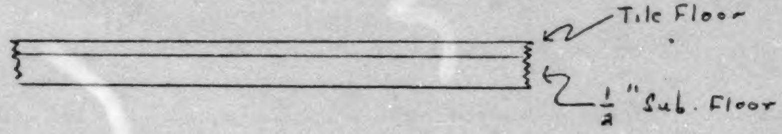
96 X 12 = 1152

5) $45 \div \frac{5}{8} = \frac{45}{1} \times \frac{8}{5} = 72$

IF THERE ARE STILL PROBLEMS IN WORKING THESE MAKE-UP A FEW EXAMPLES FOR THE STUDENT TO WORK.

12. Putting Down a Sub-Floor

In most houses a sub-floor is put down before the finish flooring is put in. A sub-floor is just what's under your wood or tile floors. Usually a carpenter will use 1/2" plywood for this job.

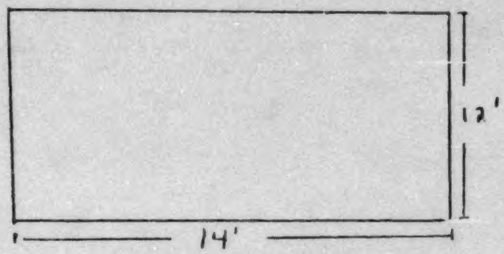


Example:

If we wanted to put a sub-floor in a room that looked like the following drawing, how many pieces of 1/2" plywood would be needed?

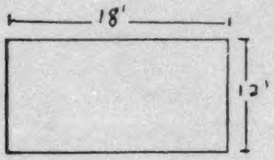
WORK THIS PROBLEM WITH THE STUDENTS AS FOLLOWS

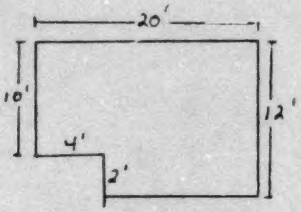
1) 14 FT. X 12 Ft. = 168 SQ.FT.
2) SINCE EACH SHEET OF PLYWOOD IS 4' X 8', EACH SHEET HAS 32 SQ. FT. IN THEM.
3) 168   32 = $5\frac{8}{32}$ SHEET OF PLYWOOD.

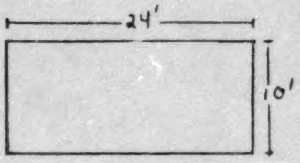


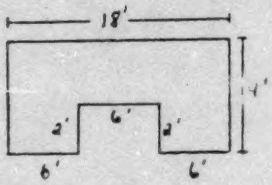
Problems:

In each of the following, find the number of sheet of 1/2" x 4' x 8' plywood will be needed to cover each floor and what its cost will be.









TEACHER NOTES CONTINUED:

) EXPLAIN TO THE STUDENTS THAT WE WILL ONLY BUY WHOLE SHEETS OF PLYWOOD AND THEREFORE, WILL NEED 6 SHEETS TO COMPLETE THE JOB.

5) IF EACH SHEET COST \$13.75 EACH OUR COST WOULD BE

$$\begin{array}{r} \$13.75 \\ \underline{\times\ 6} \\ \$82.50 \end{array}$$

BEFORE HAVING THE STUDENTS WORK THE PROBLEMS YOU MAY NEED TO WORK ANOTHER EXAMPLE.

13. Discounts.

If a contractor buys a large amount of lumber he will sometimes receive a discount on his purchase. This discount will vary from lumber yard to lumber yard. You might want to call your local dealer and find out if he gives discounts and how much. For our problem we will give a discount of 15% off of the total purchase. This means you must first find the total cost of an order and then take off 15% to find the cost to the contractor. This price after discount is called the net cost.

Find the net cost of the following order, use the price list given to you to figure the cost of each item.

YOU SHOULD DISCUSS THE USE OF DISCOUNTS WITH THE STUDENTS. ASK WHY DISCOUNTS WOULD BE GIVEN, ARE THEY GOOD FOR BUSINESS, WHY DOESN'T EVERYONE GET THEM, ETC.
THIS PROBLEM IS SOMEWHAT COMPLICATED AND SHOULD BE WORKED IN CLASS. YOU MAY WISH TO GIVE ASSISTANCE AND EXPLANATION AS THE STUDENTS WORK. THE PROBLEM REQUIRES THE STUDENT TO USE MANY OF THE IDEAS THEY HAVE ALREADY LEARNED

BUILDERS SUPPLY COMPANY

#	Description	Unit Cost	
25	1/2 x 4 x 8 AC plywood		
100	2 x 4 x 16 spruce		
20	1 x 12 x 12 yellow pine		
20 lbs.	common nails		
10	2 x 10 x 12 yellow pine		
	TOTAL		
	DISCOUNT 15%		
	NET COST		

14. Summary and Discussion

What do you think of the job?

DISCUSS THE DIFFERENT TOPICS THAT HAVE BEEN COVERED AND REVIEWED WHERE NECESSARY.

ASK STUDENTS TO DISCUSS THE DIFFERENT ASPECTS OF THE JOB AND WHAT THEY THINK OF THE WORK.

ACTUAL LUMBER MEASUREMENTS

DESCRIPTION	ACTUAL MEASUREMENT
2 x 4	$1\frac{1}{2}$" x $3\frac{1}{2}$"
2 x 6	$1\frac{1}{2}$" x $5\frac{1}{2}$"
2 x 8	$1\frac{1}{2}$" x $7\frac{1}{2}$"
2 x 10	$1\frac{1}{2}$" x $9\frac{1}{2}$"
2 x 12	$1\frac{1}{2}$" x $11\frac{1}{2}$"
1 x 4	$\frac{3}{4}$" x $3\frac{1}{2}$"
1 x 6	$\frac{3}{4}$" x $5\frac{1}{2}$"
1 x 8	$\frac{3}{4}$" x $7\frac{1}{2}$"
1 x 10	$\frac{3}{4}$" x $9\frac{1}{2}$"
1 x 12	$\frac{3}{4}$" x $11\frac{1}{2}$"
4 x 4	$3\frac{1}{2}$" x $3\frac{1}{2}$"
4 x 6	$3\frac{1}{2}$" x $5\frac{1}{2}$"
4 x 8	$3\frac{1}{2}$" x $7\frac{1}{2}$"

Plywood is always the same size as the description, for example a piece of plywood 1/2" x 4' x 8' is actually 1/2 inch by 4 feet x 8 feet.

Description	Price
2 x 4 Spruce	20¢ Linear feet
2 x 6 #2 yellow pine	31¢ Linear feet
2 x 8 #2 yellow pine	39¢ Linear feet
2 x 10 #2 yellow pine	58¢ Linear feet
2 x 12 #2 yellow pine	70¢ Linear feet
1 x 4 common yellow pine	16¢ Linear feet
1 x 6 common yellow pine	24¢ Linear feet
1 x 8 common yellow pine	32¢ Linear feet
1 x 10 common yellow pine	41¢ Linear feet
1 x 12 common yellow pine	53¢ Linear feet
$\frac{3}{4}$ x 4 x 8 AD plywood	$14.75 per sheet
	$15.52 per sheet
$\frac{3}{4}$ x 4 x 8 AC plywood	$13.75 per sheet
$\frac{1}{2}$ x 4 x 8 AC plywood	
$\frac{1}{4}$ x 4 x 8 AC plywood	
Paint (white)	$3.25 per gallon
	$1.25 per quart
Paint (colors)	$4.25 per gallon
	$2.10 per quart
Common Nails	30¢ per pound
Finish Nails	35¢ per pound
Box Nails	35¢ per pound